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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

CONTENTS

VOL. XLI., No. 7. FRIDAY, AUGUST 17, 1906.

The New York State Railroad Commission, in addition to promoting the killing of men at grade crossings by being supine instead of effective in availing of the present good law, is this year making an ill-judged use of the $250,000 appropriated by the legislature for the state's quarter of the cost of avoiding grade crossings by carrying the railroad either over or under highways. A member of the Commission is our authority for the statement that it has already frittered away two-thirds of this large sum in scattered spots throughout the state with no general plan for accomplishing the greatest benefit by clearing up a region. Furthermore, it has not been done in good faith, for the following reasons: The New York Central decided, in response to general public demand, to safeguard the traffic through the Park avenue tunnel, to increase the capacity of the Grand Central terminal and give better, more frequent and reliable service in the suburban region and to near-by cities by electrifying, not only the terminal, but also all the approaches to the city from Croton on the main line and from White Plains on the Harlem. It was obvious that, with the enormous increase in number of trains in this suburban zone, any grade crossing was impossible—too many lives would be lost. For example, at Mount Vernon, on racing days, crowds of thousands cross the track and the conditions would be ripe for ploughing up and making a killing which would shock the world. More than a year ago there was submitted to the Commissioners a list of grade crossings, in the order of their importance, and suggestions made that the state make partial appropriations as shown in the table. These eleven interested communities were not only willing, but anxious, to pay their quarter of the cost; the railroad company wanted to pay its half in addition to an additional expenditure of $15,000,000 for accompanying improvements, and the Commission stood alone in blocking the way to an improvement in the value of property, more expeditious service and saving the lives of people hit by passing trains:

Order of importance.	Location.	Estimated cost.	Estimated final cost to the state.	Suggested partial appropriation.
1	Yonkers	$618,460	$154,615	$100,000
2	Mount Vernon	303,000	75,750	50,000
3	Ossining	146,848	36,712	20,000
4	Hastings.	73,100	18,275	10,000
5	Irvington	54,000	13,500	5,000
6	Tarrytown	179,600	44,900	25,000
7	Bronxville	46,400	11,600	5,000
8	Tuckahoe	92,000	23,000	10,000
9	East Chester	18,500	4,625	4,625
10	Hartsdale	65,400	16,350	10,000
11	White Plains	200,000	50,000	25,000
	Totals	$1,797,308	$449,327	$264,625

Accompanying this table the suggestion was made that the Board of Railroad Commissioners, after giving the usual public hearings, should approve the plans which would then properly authorize the local communities to do their part of the work, and the Board should appropriate in each case a portion of the total estimated cost, leaving the remaining portions to be covered by such appropriations as the legislature might make. The railroad company was requested to assume the risk of these later appropriations being made, to which it assented. Inasmuch as in many cases several years will elapse before the state will be called upon to pay its proportion of the cost, it would appear as if these partial appropriations would be ample, and at the same time the Board would not exceed its authority under the Higgins law. The work could then actively proceed and the communities secure the benefits accruing from the elimination of dangerous grade crossings and from an improved transportation service.

The subsequent proceedings continue to be interesting: The communities concerned and the company joined this year in asking the legislature to appropriate $250,000 in order to accomplish this great public benefit. The appropriation was made, and then, for the first time in its existence the State Railroad Commission, with its politicians, its stained office-holder and statesman conductor, got busy and diverted that money from the purpose intended, and so mended their political fences. The bad result is a stagnation of property values and local improvements, and a present loss of improved transportation service north of High Bridge, on the main line, and north of Wakefield on the Harlem, for the New York Central announces that it will not—dare not—electrify to Croton and White Plains and pay for the lives of people which its trains will surely hit at grade crossings.

THE STREET RAILWAY AND THE COMMUNITY.

On Saturday afternoon, August 11, at 3:30 o'clock, at the height of the Coney Island rush traffic, Justice Gaynor, of the New York Supreme Court, handed down a decision to the effect that a certain passenger did not commit breach of peace in refusing to pay two fares for the trip from Brooklyn to Coney Island, and added as an obiter his opinion that the Brooklyn Heights Railroad Co. had no right to exact two fares for a continuous ride over its owned and leased properties. The learned Justice created no new ruling, in fact, his obiter contradicted the decision of the Appellate division of his own court, handed down last summer, that two fares between New York and Coney Island were legal. That is to say, a judge of the lower branch of a court went out of his way to reverse (if the term may be allowed, where no reversal was technically

possible) the judges of the higher branch of the same court. His opinion under these circumstances carried just the same weight as the opinion of an editor; valuable, perhaps; interesting, certainly; but not law.

But the furore which this extra-legal opinion created has had no parallel in the history of rapid transit. The newspapers of the lower order blazed forth with great headlines proclaiming that no one need pay but one fare from New York to Coney Island. Borough President Bird S. Coler raced about in his automobile urging the company's patrons to resist the extra payment—gave his best efforts to incite a riot, and was quite successful. The Brooklyn Rapid Transit Company, with law and justice entirely on its side, and undoubtedly with full knowledge of the resistance which the enforcement of those rights would cause, proceeded to strict enforcement, and at the point on its line where the five cent limit was reached, it proceeded to demand the additional fare and to eject from its cars those who refused to pay. This is the method used in such cases by, so far as we know, every railroad in the world. The law requires that in such ejectments no more force than is necessary shall be used. In the riots which ensued, undoubtedly some employees lost their temper and fought with those who wanted to fight. The criticism, therefore, if any, is that the company was undiplomatic. The possibility of municipal ownership is a danger not to the transportation companies but to the people, and by so much as the Brooklyn Rapid Transit Co., in its violent assertion of its own rights, put a weapon in the hands of the demagogues, it erred, for the Borough of Brooklyn has become the storm center of this form of demagogism.

The attitude of Brooklyn toward its transportation service has been inexplicable to many who do not recall the history of the companies now consolidated. The original charters of many of these companies were granted recklessly and abused by those who obtained them. The street railways were badly constructed, overcapitalized and starved. When, a few years ago, the present management took charge, it found what might be called a nearly universal and justifiable hostility to the rapid transit system. The rail ends were imperfectly bonded and none of them welded, so that the company sustained a great loss of power and the waste currents did damage to an alarming extent. The elevated structures, which were at once inspected by expert engineers, were so weak and dangerous that the management was in doubt whether or not to stop the service on them immediately. The power houses were entirely inadequate for the movement of enough cars to properly serve the public. The first duties were plain: to weld the rail ends and stop the loss and annoyance; to strengthen the elevated structure and prevent the possibility of a terrible disaster; to increase the power and make it adequate.

The company having accomplished this much has found itself absolutely blocked in extending its lines in Brooklyn, and in affording decent service between the boroughs of Brooklyn and Manhattan by the refusal of the authorities to allow them to make proper connections between the Williamsburg and Brooklyn bridges.

It might have been expected that the citizens of Brooklyn seeing and knowing that its rapid transit corporation was doing its best to give additional facilities and make them safe, would abandon at least a part of their hostility, but this they have not done. The municipal ownership idea and its extraordinary advocates have temporary complete control of that class of citizens which really likes riot. Hopeful people—those who believe that this Republic will endure, that people can govern themselves—consider such outbreaks as this as passing incidents. Although we wish to be classed among these hopeful persons, nevertheless we fear that temporarily the demagogues of Brooklyn have been strengthened in their unworthy cause by the action which has led up to the riots.

KILLING TRACKMEN—THE CHEAPEST WAY TO LESSEN IT.

A recent undertaking by the engineer in charge of reconstruction on a busy line to reduce the number of Italian workmen hit by passing trains had an interesting result. To further safeguard these men, a set of rules for foremen was worked out with the intention of printing it and enforcing it. Rule 3 was as follows: "A watchman must be stationed at all times where he can see approaching trains so as to warn the men in sufficient time to allow them to get out of the way. The warning must be given with a whistle, as follows: One blast indicates approach of train on track No. 1; two blasts indicate approach of train on track No. 2," etc. Before this rule was drafted a collection of different kinds of whistles had been made, and one that was far-reaching and distinctive had been selected.

But the Law Department, to which the proposed order was submitted, said: "We have concluded that for the present it is better not to promulgate any rule whatever on the subject, but let men watch out for themselves." This recommendation was based on some then pending legislation on the subject, and on a Court of Appeals' decision in a case where a workman, who was hit, claimed damages because the foreman had ordered him to work without looking up, while he, the foreman, would look out for the safety of the men. The Court said the foreman had no right to assume this responsibility for the company. This decision in favor of the employer was, of course, a warning to the company to avoid an official assumption of responsibility for any definite method of watching out.

But, since this decision was made, the United States law, approved June 11, 1906, has changed one of the basic principles of the theory of negligence. Interstate railroads are now liable under certain conditions for damages occasioned by the negligence of co-employees, and it seems well to repeat what was said in these columns June 29:

> "To avoid, or at least to diminish, the heavy loss to which all the carriers will be subjected by this law, it will be necessary, first, to revise the rules for the prevention of accidents; next, to promulgate others more adequate; and then see to the strict enforcement of them. This will tend inevitably to save life and limb, and to that extent at least the law will exercise a salutary influence and accomplish a world of good."

Track work is dangerous, and the number of men killed in the reconstruction work now being done on many busy railroads is increasing, and worse than that, we fear that it is increasing more than in proportion to the number of men so employed. Heretofore it has undoubtedly been less costly to the railroads to, as quoted above, "not promulgate any order, but let men watch out for themselves." But the tendency of legislation, both by Congress and by some States, is to make the employer liable for deaths and injuries due to negligence of a co-employee who has a degree of authority over the killed or injured one. This is simply an application of the doctrine of law that what one does through another, he does himself, and it is probable that future enactments and future decisions will be to the end of determining, or making a more exact definition of what degree of authority a negligent co-employee must have in order to make the company liable. A New York state statute of this year defines as vice-principals (not fellow servants) employees entrusted with authority of superintendence, or to direct another employee in the performance of duty, or having control of the movements of a signal, switch, engine, car, train or telegraph.

The number of hours a day of useful work that a foreman can get from track workers varies greatly. There are places where it runs as low as an hour a day. Of course, the foreman knows that his value to his company depends largely on his ability to make his men trust their lives to his watchfulness and continue to work, without looking up, until the foreman or watchman shouts. Beckoning is not enough, and, theoretically, a whistle, of a tone not to be confounded with any other whistle, is a more definite and inspiring warning than shouting.

It does no good to have ignorant workmen sign contracts exempting their employer from liability. Before a jury this gives the attorney for the plaintiff a fine chance to prejudice the case by claiming that this poor working man, not knowing or thinking of the dangers, could only get a chance to work by signing his life away.

In view of the recent laws, the tendency of legislation and the number of men killed on track work, it would seem to be wise to voluntarily assume the responsibilities which are coming, and take steps to reduce the killing and the cost of it. This would mean a more careful study of the art of protecting workmen on track and officially promulgating definite instructions. The engineers and foremen do the best they can, but heretofore, generally, engineers have not been allowed to formulate and print definite instructions, and make foremen and watchmen pass an examination on their understanding of those instructions.

DELAY AND DIVERSION OF FREIGHT CARS.

The only hope of ameliorating the evils of the freight-car situation hangs on the car service committee of the American Railway Association. Everybody admits the existence of the evils—wrongful use of foreign cars on your own road, and sending such cars to other roads without leave, both for real traffic needs and for the

purpose of cheating the owner out of 75 cents a day; and everybody is dumb, or, at least, extremely diffident when it comes to naming the remedy. The reader has doubtless noted the nonplussed state of the minds of the car service men as shown in the *Railroad Gazette* of August 10. Nobody can reason out a remedy. Reasoners naturally feel satisfied only with a remedy that seems likely to succeed everywhere, and no such remedy has been found. This being the case, there will be a perpetual deadlock unless some arbitrary power can secure the adoption of a remedy that is only partly satisfactory. Only an arbitrary power would dare to adopt a remedy admittedly imperfect. The committee is such a power. Far be it from us to call those estimable, efficient and amiable gentlemen arbitrary, in their acts or their dispositions, nevertheless we look hopefully to them to force a reform which may not be susceptible of a complete defense by reasoning. What we mean is this: Everybody is at sea as to what ought to be done first, and yet is anxious to have something done. In that frame of mind there will be a strong sentiment in favor of action by the Association in October. The commitee being the only body that has given to the subject the necessary amount of study, reflection and experiment, its views will be the only ones that logically can prevail. As no one else will be able to marshal the facts for a case against the committee, the committee must carry its point, right or wrong; that is, arbitrarily. Was not that the way that per diem was adopted? Again, we are emboldened in our rashness in the role of prophet by the action at Chicago last April on the diversion question. The Association backed the committee unanimously.

This indorsement of the committee's proposal that diversion of cars be punished only when the owner has officially forbidden the diversion of specified cars to specified roads was substantially an order to propose at the next meeting a rule prescribing a penalty for diversion. As it is fair to expect that such a report will be forthcoming, it is worth while again to give the committee's reasons for not recommending more drastic action.*

Although the committee is severely cautious and dignified in its language, it is clear that its conclusions may be summarized as (1) a higher per diem rate would be a very risky experiment, (2) delays and diversions cannot be provided against by an automatic rule. On the other hand, a rule which goes into effect at the will of the car owner has been worked, with increasing success, for four years (in the matter of penalty for delay). Under such a rule, applied to diversion, each road can keep its cars on preferred routes, and can prohibit everybody from sending them to any road which has not dealt fairly in the past. Such a road will find itself ostracized, as it were; will find all its neighbors enjoined, under penalty, from delivering foreign cars to it.

Again, if in order to break penalty, a system has divided itself for car accounting purposes, it may, under the action of a diversion rule of this kind, find each of its parts restrained from the diversion of foreign cars to each of the other parts. Thus the diversion rule would not merely be an extension of the present penalty rule, but almost the reverse of it, and railroads escaping the frying pan of a penalty for delay would find themselves in the fire of this penalty for diversion.

In our last comment on this subject we suggested that until something is done by the Association, everybody should use the telegraph and the Golden Rule; should trace by wire very vigorously for his own cars and use his conscience scrupulously in the handling of other people's cars. An esteemed correspondent has mildly ridiculed the last suggestion. Not that he has not a conscience—he has one, and it is in use—but that there is no use in trying to make men honest by rule except as we can devise a rule which will make it for their interest to be honest. We admit the force of the criticism, but we are just old-fashioned enough to like to set the Golden Rule up to look at now and then. We should have great hopes from the other half of our recommendation. With the world as it is, the next best thing to forcing our unreliable neighbor to exercise a conscience is to force him to admit that he hasn't any. The mental exercise may do him good. If you follow up your cars closely enough you may be able to make some headway in that direction with evildoers. The vigorous tracing of cars might have a salutary influence, even during the short time between now and October. After October we can try something more direct; the committee may be expected to give us a good weapon in the combination of frying pan and fire above referred to.

*The idea is frequently expressed that we shall be able in the near future, by increasing the per diem rates, to put it at such a point that we shall be able to do away with the penalty rate feature altogether, but the Committee fears that if we adopt too high a rate, we shall interfere seriously with the free movement of freight cars when loaded, and cause a large amount of unnecessary empty mileage with foreign cars. Certainly when cars are plenty, a high per diem rate would result in frequent transfers at junction points, and in the hurrying home of cars which are really not needed there.

Without, however, deciding whether or not it will ever be practicable to do away with "penalty," it is obvious that the present per diem rate is not sufficient to move cars in periods of car shortage, and that the penalty arrangement must be maintained for the present.

With the idea of avoiding unnecessary empty foreign mileage when cars are plenty, the present rule is so arranged that it is not automatic, and delay can only be penalized when cars are held in contravention of the expressed wish of the car owners. Under this rule, arrangements are frequently made by which certain railroads are not penalized for delay, and thereby unnecessary empty mileage is often saved.

The Committee feels that any automatic rule for diversion would result in the unnecessary transfer of cars at junction points and increased unnecessary empty mileage. It is easy to conceive of frequent cases where an automatic penalty for diversion would result either in inconvenience to the public, transfer at junction points, unnecessary empty mileage, or all three.

There are many cases where a technical diversion will serve the interests of the car owner better than a strict adherence to the home route. Under the circumstances, the Committee feels that the only safe course in framing a rule for diversion will be to adhere to the principle now tested for nearly four years in the penalty feature for delay, and to provide that no diversion shall be penalized unless it is made in contravention of the expressed wish of the car owner.

The proposition is so novel a one, however, that the Committee feels that it needs the counsel and support of the Association before formulating a diversion rule, and it therefore proposes the following resolution:

Resolved, That a penalty for diversion should be imposed only in cases where cars are delivered to specified foreign roads contrary to the expressed wish of the car owners.

In case this resolution should be approved, the Committee will use it as a basis for a rule to cover a penalty for diversion, which it will present at the next meeting of the Association.—*Extract from report presented at Chicago, April*, 1906.

THE CAPE TO CAIRO PROJECT.

Much interest was aroused the world over by the announcement that Alfred Beit had left £1,200,000 to endow the Cape to Cairo railroad and telegraph scheme. The detail of this endowment, as set forth in the will, was as follows:

> I believe that by the promotion, construction and furtherance generally of railways and telegraphs, including wireless telegraphy, telephones or other methods of transmission of persons, goods and messages, civilization will be best advanced, especially in Africa, for the benefit of the inhabitants of that country, whether native or immigrant, and I know from experience how difficult it is at times to find funds for the construction of such methods of transmission in new and undeveloped countries.

He makes provision "for the purpose of assisting the promotion, construction, equipment, or furtherance of any such method of transmission, as aforesaid, in south and north Rhodesia, Portuguese Africa, both east and west, German East Africa and such other parts of Africa as may be traversed in establishing what is known as the Cape to Cairo Railway and the Cape to Cairo telegraph system, including telephones."

So far as we know, this is the first time that railroad construction has been specifically provided for by endowment, and we look upon Mr. Beit, like Cecil Rhodes, as a strong man to whom the great African country was dear. These were two builders of empire, even though their methods of building were large methods and harsh ones. Rhodes built during his lifetime. The work of Beit while he lived was more obscure—he was rather the banker than the active builder—and it is not until his death that the extent of his interest in the country has been shown.

But in view of this interesting and unusual bequest, it is worth while to again take up for brief review the Cape to Cairo project that has been so widely exploited, with so little hope of fulfilment. There was printed in the *Railroad Gazette* just a year ago an account of the existing South African railroad system, in which it was shown that at the time of the Boer war the communications north and northeast from Cape Town were over the Cape Government Railway to Vryburg and thence on to Bulawayo, 588 miles northwest of Vryburg, over the lines of the Bechuanaland Railways, Bulawayo having been reached by this system in 1897. After the war the Bechuanaland Railways became the Rhodesia Railways, connecting with the Cape Government system at Mafeking. North from Bulawayo the lines now form a rough letter U, the Rhodesian Railways inclining northwest to the Victoria Falls on the Zambesi river and then north again on an extension now in progress which, at last advices, reached to Broken Hill, 107 miles north of the Kafue river, and 2,013 miles by rail from Cape Town. Northeast from Bulawayo the Beira & Mashonaland Railroad practically continues the direction which the Rhodesian Railways take south of Bulawayo, and extends as far as Salisbury, near which point a junction is made with the line which starts from the port of Beira on the Indian ocean and runs northwest.

The distance from Cape Town to Vryburg is 774 miles; from Vryburg to Victoria Falls 870 miles, and from Victoria Falls to Broken Hill, 373 miles more, making this total of 2,013 miles which have been built from the Cape along the general longitudinal axis of Africa. This is the south end of the route. From the Mediterranean end of Africa, the Egyptian State and Egyptian-Soudan railroads afford communication from Alexandria to Khartoum, which is approximately 1,350 miles south of Cairo by the route

traversed. A portion of this route is by steamer, but connections are made with trains having through sleeping car and dining car accommodations, so that it is essentially a completed and serviceable system of travel. The rails stop a short distance south of Khartoum. The next stage of the journey may now be performed by river steamer from Khartoum to Gondokoro, 1,181 miles. Gondokoro is located in the northwest corner of British East Africa on the River Nile, about 200 miles from Lake Albert Nyanza. In this part of Africa there is now in operation the Uganda Railway, which runs from Mombasa, on the coast of British East Africa, about 175 miles north of Zanzibar, to Lake Victoria Nyanza on the equator, but this railroad does not help in establishing communications between Cairo and the Cape, being primarily an east and west route from seaboard.

Supposing that the Rhodesia Railways are connected with the Egyptian-Soudan Railways, the route seems likely to lie by way of Stanley Falls on the Congo, and Gondokoro. From Broken Hill to Stanley Falls, which may roughly be described as located at the bisection of the eastern part of the Congo with the equator, the rail distance should be about 1,325 miles, and from Stanley Falls to Gondokoro on the Nile it should be about 600 miles. Add the 1,181 miles from Gondokoro to Khartoum and it will be seen that something over 3,100 miles of railroad will have to be built through the equatorial part of Africa.

The project is not an encouraging one. In fact, it is so discouraging that we have often stated that it may safely be predicted that no Cape to Cairo railroad would be seen by any one now living. In the first place, there is no commercial need for a trans-African railroad, and the basis reason for this is that the parts of Africa which either supply traffic or seem likely to are much better adapted for sea routes than they are for rail routes. The whole trade of the 3,000 difficult miles between the Zambesi and Khartoum can almost be disregarded from a railroad standpoint, while most of this trade, such as it is, is tapped by the Uganda line, which was built to carry it direct to the coast of the Indian ocean, giving a short haul by rail and the long haul by sea.

It has also been pointed out as a minor difficulty that the Rhodesian system, the Uganda and the Egyptian-Soudan lines are built on three different gages. The Cape system is 3 ft. 6 in. throughout; the Uganda line, approximately 585 miles long, is of 3 ft. 3⅜ in. gage, laid with light rails not adapted to carrying the rolling stock either of the Cape or of the Egyptian system, while the Egyptian lines are in part 4 ft. 8½ in. gage, from Alexandria to Luxor, say 400 miles south of Cairo; they are 3 ft. 6 in. gage from Luxor to Shellal, 150 miles, and 3 ft. 6 in. gage from Wady Halfa to Khartoum. A gap exists between Shellal and Wady Halfa, as mentioned, and on this 200-mile stretch traffic is now carried on river steamers.

The engineering difficulties of the route need not now be dwelt on, further than to point out the great swampy area which lies between Gondokoro and Lake Albert Nyanza.

Alfred Beit has left $6,000,000 to further this project. Supposing that a railroad could be built and equipped in the equatorial Africa region for $50,000 a mile, which is doubtful, this sum would build 120 miles. If it could be built for $25,000 a mile, which is impossible, 240 miles would be accounted for. Supposing that 240 miles were built, there remains a stretch of some 2,800 miles, discouraging alike to the engineer, the contractor and the traffic man. Just what economic use Central Africa is ultimately to be put to in the scheme of the world's commerce and industry we do not know, but we unhestitatingly advise those who wish to journey from Alexandria to the Cape to go by sea, and to plan to go by sea for the rest of their lives.

Westinghouse Electric & Manufacturing Company.

For the first time in more than five years a formal report has been submitted to the stockholders, the last statement, covering the period up to March 31, 1900, having been presented at a meeting held Feb. 20, 1901. The present income statement therefore covers a period of six years. It shows gross earnings of $114,618,537, operating expenses $97,726,009, leaving net earnings of $16,892,529. After various additions and deductions from these net earnings, including among the latter the $9,922,070 paid during the six years in dividends, the company's surplus on March 31, 1906, was $11,540,642.

The general balance sheet of that date shows factory plants at East Pittsburg and Allegheny, Pa., and Newark, N. J., including machinery and equipment, carried at $10,630,000. Under "Investments," stocks and bonds of subsidiary American manufacturing companies of a par value of $7,210,900 are carried at $5,191,000, and stocks and bonds of foreign companies of a par value of $13,750,000, at $10,661,000. There are also included here the stocks and bonds of the Lackawanna & Wyoming Valley Rapid Transit Company, the third rail electric road between Scranton and Wilkesbarre, Pa., carried at $6,300,000, an item which appears for the first time in the company's statement. The item most to be criticized, on account of its obscurity is "Other Assets," $7,034,537. This includes charters, franchises, patents, office furniture and fixtures, insurance and taxes paid in advance—a collection of asset items which might easily range from actual cash to the most valueless sort of "good will."

There is reported the recent securing of important contracts, aggregating $6,000,000, from the municipal authorities of St. Petersburg, for building electric tramways in that city. As a result, a company has been organized under French laws to take over an electric manufacturing plant already in operation in Moscow which will take in hand the business of providing for the new contract. Attention is called to the development of the single-phase alternating-current system of railroad operation as the most brilliant accomplishment of the company's development work, a department which requires the services of 45 per cent. of the engineering force. On the following roads the system is already in successful operation: The Long Island, Atlanta & Northern Railway, Indianapolis & Cincinnati Traction, Vallejo, Benecia & Napa Valley, and the Warren & Jamestown Street Railway. Other steam roads, or new roads on which the single-phase system is being installed are the New York, New Haven & Hartford between Woodlawn, N. Y., and Stamford, Conn.; the Grand Trunk for the electrification of its Sarnia tunnel; the Spokane & Inland Railroad, a new road in the state of Washington, for the complete operation of its lines; the Fort Wayne & Springfield Railway, and the Springfield & Butler Traction. For testing purposes a line of road between East Pittsburg and Trafford City has been equipped by the company with the latest type of catenary suspension trolley line for high tension alternating current transmission. Here the single-phase electric locomotives manufactured are tested. This road is also fitted with third rail and substations for testing direct-current locomotives.

Sales during the past year have shown large increases. Sales of railroad motors, for instance, have increased 51 per cent. over any previous year; of the electro-pneumatic unit switch system of multiple control, over 60 per cent., and of turbo-generators 94 per cent. over any earlier year. The following table shows sales for the last six fiscal years:

Year ended March 31, 1901	$12,516,072
Year ended March 31, 1902	17,927,340
Year ended March 31, 1903	19,571,294
Year ended March 31, 1904	18,569,614
Year ended March 31, 1905	16,570,717
Year ended March 31, 1906	24,939,602

If sales for the current year keep up to the average of the first five months of the calendar year 1906 (more than $2,850,000 a month), as it is stated may reasonably be expected, the total sales will amount to $34,000,000, as against $24,940,000 in the last fiscal year.

The report loses strength and significance as a statement of the company's affairs from the numerous partisan statements which it contains. For example, in regard to the single-phase alternating current system, the Second Vice-President says: "The system furnishes the only means to-day by which existing steam roads can be economically operated by electric power." Similar remarks are made about the company's output in nearly every department. It is evident, however, that the company is obtaining a large share in the great prosperity which is to-day so characteristic of the electric manufacturing and supply business.

Last week, Tuesday, August 7th, some 260 switchmen employed in the New Haven local yards of the New York, New Haven & Hartford Railroad went on strike, filing with the company a statement of their grievances. These included, among other things, dissatisfaction with the assistant yardmaster. Most of the strikers were members of the Brotherhood of Railroad Trainmen. On last Saturday, August 11, the strike was broken by the following order signed by two of the higher officers of the brotherhood:

To Chairmen of all Grievance Committees on the New Haven System:

Make copies and post where all members can see the following: The undersigned officers on the ground find an illegal strike in effect in the yard service at New Haven, many of our members participating; men on strike now ready to resume duty; company not willing to re-employ them.

We must concede the position of the company is justified. We have told the company our organization would do its duty fearlessly and protect contract. Members are cautioned to remain at work and pay no attention to those who might try to influence them to risk their places, as the brotherhood will co-operate with the company to protect contract.

Capable men, members of our organization, in search of employment are requested to report to the undersigned, as a number of men are required to fill positions at present vacant. (Signed) VAL FITZPATRICK,
JAMES MURDOCK.

Mr. Fitzpatrick is Second Vice Grand Master, and Mr. Murdock, Fourth Vice Grand Master of the brotherhood. Their action was taken after consultation with the General Manager of the road.

It was proved to the satisfaction of the union officers that the strike, which was undertaken entirely without authority from the central body of the organization, was unwarranted and that the company was not willing to take back the strikers into its employ. Therefore the influence of the whole organization of railroad trainmen was thrown in favor of the railroad company and against the striking group of their own members. This, contrasted with the record of labor unions in general, is a remarkable instance of sincerity and prompt action in defence of the employer's side of a contract on the part of a labor union. In the railroad service, however, it probably is by no means exceptional, and merely goes to show again the marked superiority of the railroad organizations over the general run of unions. If all unions could include men of a high enough stamp to have the moral courage to take action against their own members when those members had broken their contract with their employer, the labor union question would lose most of its dangerous features.

Two eastern railroads within a year have submitted their schedules to the referendum. Last May the Erie asked its commuters to record their use of the Twenty-third street ferry, in New York, and the Long Island now goes further, and seeks definite suggestions about the fall time-table. Mr. Peters' circular is as follows:

> It is expected that the time-table will be changed from the summer to the fall arrangement early in September, and generally the trains will be about the same as shown on time-table in force from May 17 to June 14 this year. That trains may be arranged to accommodate patrons as much as possible, they are requested to express their wishes to the Traffic Manager or General Passenger Agent, at 263 Fifth avenue, New York, by letter before Aug. 10, 1906. It is desired that these communications be written on only one side of single-sheet letter paper.

This announcement was placarded in a conspicuous manner, and received nearly 100 replies. Many of the smaller communities along the line were chiefly concerned in securing the stoppage of through expresses, and such requests as these it was usually impossible to grant. But a number of helpful and practical suggestions with regard to minor adjustments were brought out, and these have proved of considerable service to the company in planning schedules to give the maximum amount of satisfaction. The experiment was clearly a success, and will be repeated. It seems evident that the best way to stop complaints about passenger schedules is to interest the people who use them in the making of them. Suburban passengers want the railroad to do as well as it can, and the railroad most assuredly wants to do as well as it can by them, for the better pleased they are, the more of them there will be. The experiment of giving them at least an advisory voice in train management costs nothing except the printing of the posters, and ought to be a very effective way of nipping hostility in the bud.

July Railroad Law.

The following abstracts cover the principal decisions in railroad cases handed down during July by the United States Supreme Court and the other federal courts:

Franchise Taxes.—The refusal of the taxing authorities of a State to allow a deduction from the capital stock of a railroad company which is taken as the basis of a franchise tax imposed by law on acount of the considerable proportion of its rolling stock which in due course of business is always absent from the State, does not amount to an interference with interstate commerce or a taking of property without due process of law within the meaning of the federal constitution, and this more particularly where it is not shown that any of this property was outside the state a sufficient length of time to admit of its taxation in other states.—New York ex rel New York Central & Hudson River Railroad Co. v. Miller, 26 Sup. Ct. Rep. 714.

Interference with Interstate Commerce.—An order of a state railroad commission compelling a railroad company engaged in interstate commerce to deliver cars containing interstate shipments to a private siding beyond its right of way amounts to an unlawful interference with interstate commerce without regard to whether this action is viewed as an assertion by the commission of its general power over carriers or of its power to make such an order in a particular case in favor of a given power or corporation.—McNeill v. Southern Railroad Co., 26 Sup. Ct. Rep. 722.

Duties of Train Dispatcher.—A train dispatcher having issued orders sufficient if obeyed to insure the safe operation of trains approaching on the same track should issue supplemental orders where he knows of the disobedience of the original orders and that such disobedience will result in a collision, provided, of course, that he can reach the engineer disobeying orders in time to prevent the collision.—Santa Fe Pacific Railroad Co. v. Holmes, 26 Sup. Ct. Rep. 676.

Railroad Mail Clerk a Passenger.—The rule of the Pennsylvania courts that a railroad clerk while at work is not a passenger, but occupies the status of an employee, and is entitled to recover for injuries only in the event that an employee could recover, which rule is opposed to that accepted by most American courts, does not apply where the mail clerk, at work on a train belonging to one company, is injured in a collision between his train and a train belonging to another company on a track over which both companies have joint trackage rights.—Farrington v. Delaware & Hudson Co., 143 Fed. Rep. 565.

Injunction as Remedy for Damages.—A railroad company granted the right to build its track along a street is not to be enjoined from building its road on the ground that damage will result to abutting property owners. This question can only be litigated in an action at law for damages.—Whittaker v. Atlanta, Birmingham & Atlantic Railroad Co., 143 Fed. Rep. 583.

Future Pain an Element of Damages.—The liability of a railroad company for future damages for personal injuries is strictly limited to a compensation for such pain and other effects of the injury as are reasonably certain to result from it, and a recovery of damages for pain and suffering which may possibly result in the future should be refused as remote and speculative.—Chicago, Milwaukee & St. Paul Railway Co. v. Lindeman, 143 Fed. Rep. 946.

Trains Interfering with Operations of Fire Department.—A railroad company will not be liable for a loss by fire because one of its trains ran on tracks across which the fire department of a city was preparing to run a line of hose to a burning building even though the trainmen were signaled to stop by persons beside the track, when the fire was not visible to the trainmen, and there was no hose upon the track which they could have seen and it was not clear that the engineer heard or understood the signals or should have known of the existence of the fire.—American Sheet & Tin Plate Co. v. Pittsburg & Lake Erie Railroad Co., 143 Fed. Rep. 789.

Enjoining Location of Grade Crossing.—A Tennessee county court vested by statute with discretionary power to locate highways cannot be enjoined from making a location across the tracks of a railroad company unless the location involves the taking of property essential to the operation of the railroad or would work other irreparable injury to the railroad company or would amount to a violation of some existing law.—Cincinnati, New Orleans & Texas Pacific Railway Co. v. Morgan County, Tenn., 143 Fed. Rep. 798.

Injunction against Ticket Scalping.—Owing to the inadequacy of legal remedies to reach the evil, injunction is a proper remedy to prevent the scalping of non-transferable round trip tickets issued at reduced fare on account of public gatherings in different parts of the country and in proper cases the injunction should be permanent, reaching future violations, since the court, under a familiar equity rule, having jurisdiction of the parties and the subject matter, should in its final decree administer full relief.—Louisville & Nashville Railroad Co. v. Bitterman, 144 Fed. Rep. 34.

Injury to Trespasser on Track.—A person of mature years and in the full possession of his faculties who walks upon a railroad track for more than half a mile without once looking back or stopping to listen for an approaching train by which he was struck is wanting in ordinary care for his own safety and cannot recover damages for his injuries. He is not excused by the fact that the wind and other noises tended to deaden the sound, as such a condition should have made him more vigilant.—Northern Pacific Railway Co. v. Jones, 144 Fed. Rep. 47.

Death of Alien.—The right to recover for the wrongful killing of a person is not defeated by the fact that the person and his next of kin are citizens of a foreign country.—Baltimore & Ohio Railroad Co. v. Baldwin, 144 Fed. Rep. 53.

Crossing Signals.—The law requiring trains to signal their approach to crossings was enacted solely for the benefit of persons using the highway and a failure to sound such signals cannot be urged in an action for injuries to a trackman at work near a crossing. A like rule applies to the violation of speed ordinances.—Western Railway Co. v. Gesswine, 144 Fed. Rep. 56.

Right to Connect Switch Tracks.—Under laws making all railroads public highways and their owners common carriers, the owner of coal mining property adjoining the right of way of a railroad is entitled as a matter of right to connect switch tracks built on its own land with the track of such road to facilitate the loading and shipping of coal. Nor may the railroad company refuse to accept and transport coal tendered by a shipper on the ground that it is not uniform in quality with other coal mined on its line and that the marketing of such coal will injuriously affect the sale and consequently the shipment of the superior coal.—Olanta Coal Mining Co. v. Beech Creek Railroad Co., 144 Fed. Rep. 150.

In the Cape of Good Hope colony many of the short branches and extensions do not pay on account of ox wagon competition. In the report for the year 1905, recently issued, the traffic manager of one of the lines reports, in regard to a new 19-mile branch, that, as there was a very plentiful supply of wagons and an abundant supply of grass during the season, ox wagon rates ruled low, and the railroad secured little general traffic. The recommendation to meet this competition is to have main instead of branch line rates introduced on the new line.

Prince Khilkoff on Russian Railroads.

We have from time to time alluded to the remarkable work done by Prince Khilkoff, late Minister of Communications, in connection with the Trans-Siberian Railway during the recent war.

During his recent visit to England, in connection with the Interparliamentary Congress, he gave an interview of some length to one of the British representatives of the *Railroad Gazette*. The latter writes: "Armed with a letter of introduction from one of the best known men in Russian politics, I went to seek out Prince Khilkoff in the Painted Chamber in the House of Lords where the conference was sitting."

A perfect babel of tongues prevailed and an equal variety of costumes, Russian peasant deputies and Japanese princes, Polish revolutionaries and German land owners, American Senators and Austrian aristocrats conversing amicably together. I was, however, unable to find the object of my search until lunch time when the whole of the delegates were gathered in Westminster Hall. Here I found him seated between the Spanish and Russian Ambassadors, and subsequently I had a long talk with him at his hotel.

One of the facts which I particularly desired to get confirmed by Prince Khilkoff was the maximum capacity of a single line as constructed; he informed me that a maximum of no less than 20 trains had been passed over the line in 24 hours. This performance was the more remarkable as the line mostly consisted at that time of very light rails weighing not more than 40 lbs. per yard, laid down in a great hurry and often without proper supervision by contractors who were not over particular, at a rate, in some cases, of 10 kilometers a day. Passing places only existed every seven or eight kilometers, and the first thing that was necessary at the outbreak of the war was to add 243 new passing places, besides relaying some 2,000 kilometers of line with heavier rails. Under these circumstances, it was not surprising that the various estimates made as to the capacity of the line varied considerably. The Russian general staff at the outbreak of the war considered that seven or eight trains per day would be the maximum possible. The German general staff believed that it was capable of being made to carry 11, while our own military authorities in India, who had more practical experience of this type of railroad to go upon, estimated the possibility of 13 trains per day being passed over the line, though doubtful if this could be proved by his experience on the Trans-Siberian, for no longer single line is ever likely to be maintained. The result exceeded all estimates.

Prince Khilkoff.

The construction of the new lines was split up among contractors to an extraordinary extent. The Circum-Baikal line, on which there were 43 tunnels, was let out to 42 separate contractors, many of whom were Italians. Incidentally, one advantage possessed by the Italian workman over native labor was the fact that the former, thanks to their readiness with the knife, were far less subject to interference by Cossacks and others, who obtained a very wholesome respect for them, whereas the average native was prepared to stand a good deal of robbery and ill-treatment. On more than one occasion trains loaded with food for the troops were completely looted by the laborers themselves when short of food or by political prisoners, and it must not be supposed that the leakage of stores and clothing was as small as that of troops. The latter was remarkable indeed, no less than 780,000 to 790,000 troops being transported all these thousands of miles with a loss, attributable to railroad causes, of three or four lives only.

A great deal of work, of course, still remains to be done and, in fact, it has just been decided to build a line from the Baikal to Pokrovskzy, at the junction of the rivers Shilka and Argun. As large numbers of the Russian contractors, who did the previous work, are either bankrupt or disqualified from tendering again, it is quite possible that there is an opening for English capital in this direction, and, in any case, a large quantity of stores and railroad material will undoubtedly be required.

On the whole, Prince Khilkoff did not consider that Russian railroad men are badly paid compared with other classes of workmen. Leading engine drivers receive as much as $75 a month, and others in proportion. But the higher officials do not even nominally receive good pay. Men in charge of sections of 500 to 800 miles having sometimes under $1,000 a year, and that irregularly, it is not surprising that bribery should exist; on the whole, it appears that the only people who have made a good thing out of the Russian railroads have been the contractors, when they have got their money. The Government, however, realizing perhaps the vital importance of keeping the railroad system intact and ready for emergencies, has undertaken to spend a further $10,000,000 a year for the purpose of raising wages and improving the dwelling houses of railroad servants. This appears a large sum, but it will not go very far among the 667,000 railroad employees (including workmen, but excluding military) whose total wages at the present time amount to close on $125,000,000 a year. There is thus, as will be seen, no great opening in Russia for English railroad officials, but there does, on the other hand, appear, in view of the great extension of railroads which will take place as soon as the political horizon clears, a considerable amount of work for English contractors.

At the present time there are two express trains each way every week from St. Petersburg to Vladivostok, it being necessary to change at Irkutsk; they are not, however, as might be expected, very fast, and Prince Khilkoff stated that an enterprising newspaper which was bent upon making a fresh round-the-world record, had recently inquired from the Minister of Railways what would be the price of a special express train from one end of the system to the other, stopping not more than twice a day. The figure was unfortunately prohibitive, even for the enthusiastic journalist.

There ought to be a considerable market for further rolling stock in Russia. Prince Khilkoff said that during the war there was an idea prevalent that a great deal of rolling stock was destroyed at the other end, owing to the impossibility of returning it; as a matter of fact, this was not the case. It accumulated in large quantities at the other end of the line during the war, and during this time was often used as a living abode by officers or men, but excepting in those rare cases where the people were really so hard up for fuel in the cold weather that they did not know what to do, very little of the stock was broken up at the time. Quantities of it, however, were so seriously damaged, either by the long journey or by the treatment it received on arriving at the other end, that they had to be almost entirely reconstructed, and now workshops had been put down at the other end of the line for this purpose.

All kinds of signaling systems were used on the Siberian and on the Russian railroads, hand signaling, lever signaling, and electric, and electric signaling was very much believed in in Russia.

A good many experiments had been made in Russia with oil fuel and with wood fuel, and it was hoped that further experience would have been gained about this on the Trans-Siberian. As a matter of fact, they had no time to make experiments, or to get locomotives fitted for this purpose, and, although a certain amount of wood was burned, they mostly used coal. The Government had found it wise to acquire a very important coal field about half way to Irkutsk, where good coal could be obtained, the coal obtained nearer the other end of the line being of an indifferent quality.

Talking of Russian railroads generally, Prince Khilkoff did not consider that there was any very great likelihood of a general strike, for he thought that the demands of the railroad men were more of an economic nature than of a political one, and the men had suffered so severely in the recent strike that they were hardly

likely to throw up their jobs again. The Prince is a man of practical experience. He recently stated that during his sojourn in America he would spend from 16 to 18 hours a day in the workshop or on the footplate, and throughout that time he was acquiring everything that could be of use to him in connection with railroad operation. In fact, all those connected with Russian railroads are great believers in taking advantage of other countries' experience, and nearly all the leading railroad officials who read English subscribe to the *Railroad Gazette* with this object. Prince Khilkoff carries in his head a mass of figures connected with the operation of the Russian railroads, and is moreover, as is the case with so many of his countrymen, an excellent linguist, our conversation being conducted with equal facility in French or American, both of which he spoke fluently. He is no longer Minister of Railroads, having already had two successors, Mons. Nemjeshajev, who went out with the Witte cabinet, and was succeeded by Maj. Gen. von Schaffhausen-Schonberg-ek-Schaufuss.

The New Standard Code.

BY H. W. FORMAN.

(*Continued from page* 116.)

In the third line of the first paragraph of Rule 94 (I quote from the committee report) the word "schedule" should be changed to "identity." It may be that an extra will overtake another extra and find it necessary to exchange with it. In that case it would take its identity; extras are not scheduled. The word "identity" should be made use of in place of "right or schedule" in the sixth line. Referring to the second paragraph, it will be conceded that when a day telegraph office is closed for the night it is no longer a telegraph office until the operator comes on duty the next morning. Suppose a train should be tied up at such point and a train comes along having right or schedule which permits it to proceed, and the delayed train precedes it to the next telegraph station. After its departure the following train pulls out the end of a car and is delayed until 7 a.m. The day operator comes on duty and reports to the train despatcher that the train is still at his station; the despatcher sends an order to meet at that station a train which the formerly-tied-up train is running against on the right of this following train. Would not there be a very good chance for a collision if the conductor of the train having the draft rigging out did not fully explain to the despatcher what had been done? Can he be depended upon to do that? The operator might, contrary to rule, notify him he had orders for him, instead of getting signature, and fail to say what kind of orders, and the conductor might neglect to ask. Conductors are likely to assume in such cases that the train using his right has been located and restricted, or has reached the next telegraph station, when such may not be the case. In all such cases the following train should place on the train running ahead of it a flagman to hold all opposing trains until it arrives.

In Rule 95 the words "Two or more sections may be run on the same schedule" are found. This provision is harmless, but unnecessary. After reading the definition for a section, Rule 20 and Form F, it will be seen that it is no more necessary to say that sections may be run than it is to prescribe that regular trains and extras may be. Nor does it appear to be necessary to say that extra trains must not be run without train order authority. Rule 201 and Form G clearly indicate that it must not be done.

Rule 104 should say what is meant by "in charge." Has the rule been complied with when the man who says he will look after closing the switch is some thousand feet distant from it? If the rule read "A switch must not be left turned from its normal position for a following train unless one of the crew of such train is at the switch and has taken charge of it," many doubts would be cleared up. There should be another rule making the engineman responsible for the switch when the train is backed in on a siding, as the front brakeman is then usually some half mile from the train protecting the back-in movement.

Rule 206 does not prescribe the safest practice. It is much better to spell out "second," than to write "2d." The additional time required to do so is not worthy of notice. In my opinion, the Association is making a mistake in recommending that time be stated in figures only. Several years ago a large road changed its rules, which then required time to be spelled out and duplicated by figures, to the code method of stating it in figures only; and this for no other reason than that its officers were loyal supporters of the code and desired to be in harmony with it and with other large roads. In a year or two thereafter a frightful collision occurred on that road through mistaking the figure "3" for a "5," and many persons were killed and injured. I have no doubt many officers adopt certain rules in the code against their judgment for the sake of uniformity. Here is an instance where it may be dangerous, and certainly is of no benefit. Hundreds of orders are turned in at my office daily and I have yet to find one where both the words and the figures representing time are so poorly made as to make both indecipherable, although orders are sometimes found not clear as to a certain word or figure.

The "middle order" authorized by Rule 208 B is becoming popular because it is an additional safeguard. While about one-fourth more time is consumed in fixing a meeting point in this manner it is time well spent. But when it is remembered that the order is sent to the trains interested before the meeting point is reached, I have queried if the operator at the meeting place could not just as well be relieved from having to repeat his copy to the despatcher, thus saving the time taken up in doing so. Such operator can carefully check his copy while it is being repeated by the operator who receives it for the superior train and then reply "Checked," and receive "Complete." Should there be an error in his copy, which is improbable, the train crews would call attention to it and, until such mistake was corrected, would of course be governed by the copy delivered to them before arriving at the meeting point.

Typewritten orders are becoming common. The type usually furnished with typewriters is objectionable because so small that there is too much chance of a figure being misread. Also, the orders are sometimes difficult to decipher by firebox light on engines at night. But if type known as standard large Roman is used an excellent copy can be made in this manner.

There does not appear to be any good reason for despatchers sending the initials of the superintendent every time they "complete" an order; the provision could well be omitted from Rules 210 and 211.

Rule 214 seems a little more strict than is necessary. After an operator has repeated an order to a despatcher addressed to No. 1 to run one hour late, and has received the usual assurance that the despatcher has heard him repeat it, I can see no objection to the operator completing such order if, after the conductor of No. 1 has endorsed his name thereon, it be found that the wires have gone down. To treat the order only as a holding order delays No. 1 and probably other trains. Even though the rules do not require the despatcher to acknowledge having heard the operator repeat the order, they often do so by replying "i" or "o k."

Rule 215 should read: "The operator who receives and delivers a train order must preserve a copy." It is immaterial whether it by the lowest copy, provided he keeps one on which appear the signatures.

There is some risk in connection with Rule 218, and it should be provided against by elaborating the rule, or by requiring the despatcher to advise operators in some way when a schedule is represented by sections and the sections are not stated in either the address or the body of the order. Operators are not mind readers and might deliver the order to the first section, and, not knowing there are more, change their order-signal to "proceed" and allow a following section to pass without receiving a copy. Operators are often so situated that they cannot see the signals on the front of engines, and the rules do not require enginemen to call attention by whistle to such signals for operators' information.

When running orders are annulled, or one section passes another, or when extras receive short running orders and hold other orders that may concern them after receiving new running orders, there is some question as to the standing of orders held by such trains. Do they become void at the time the running orders expire or are annulled, or the section is withdrawn? This point does not appear to have been clearly covered by code rules. An effort has been made to clear up the question in new rules which will be found below under the caption of "governing principles." Rule 220 does not fully provide for such cases.

In the train order forms it will be noticed that there is not uniformity in the references. Sometimes the expression "Under (3)" is used, again it is "Under example (8)." If throughout the code references were made thus, "Under Example 3," the work would look better.

The standard code still lacks a few examples of forms quite commonly used.

The words "For Opposing Trains" do not seem to be necessary in the caption of Form A. In Form B, the explanation of Example 3 is not as clearly stated as is necessary to avoid delay and misunderstanding. Form C is too narrow. It should provide for giving right over another train without regard to direction. There are three conditions necessary to be taken care of under this form: Establishment of the fact that such an order makes a train superior to another, and prescribing how many minutes the train thus made inferior shall clear the other train; giving instructions as to which train shall take the siding at the first and last named stations and also at stations within the designated limits; and providing for identification in case the trains meet within the limits. Failure of the rule to require the train made inferior to stop the superior train and identify itself to it might result in a collision, if the train over which right is given should reach a point within the limits by time-table, or time-order, or by flagging with some other train. This can be illustrated by a case where No. 2 is given right over first No. 1 from E to A. Should first No. 1 be able to make B and properly clear the time of No. 2 it may go there. If it does, and is not identified, No. 2, not knowing that the first section of No. 1 has been met, is likely to run from B to A without help against second No. 1, while second No. 1, not being restricted, may closely

follow the first section out of A; and thus cause a collision either between A and B, or at B. Also, not knowing that the train over which right is given has been met, No. 2 is put to the inconvenience of taking the siding at A for nothing, and, should such station be a blind siding and not be provided with a train register, the train might be tied up for No. 1. To allow a condition of this kind to arise may be said to be poor train despatching, but such orders have been given and are likely to be issued in the future.

It is wrong to use an even hour in a "wait" order, as is done in Form E, Example 4. Many roads duplicate time by spelling and in such cases trainmen have been known to misunderstand an order giving them until ten 10 a.m. to make a station, taking it to mean that they had until ten minutes past the hour. Train despatchers should be instructed to express time thus—9.59 a.m., or 10.01 a.m.; and examples given to them should be consistent with this instruction. Example 4 will be burdensome where the "middle order" is used, as operators at the several waiting points must each receive a copy. To avoid this the "Late Schedule" form of order will be found advantageous and will be referred to below. That "the time in the order should be such as can be easily added to the schedule time" does not impress me as being necessary or practicable. If the time of trains at stations always ended with a "5" or "0," or trains could be depended upon to show up an even number of hours late, the principle could be applied, but not under existing conditions.

The heading of Form F could be changed to read, "Form F. Creating and Changing Sections." In this form, Example 8 means that if there be five sections of No. 1 and an order is addressed to all, instructing the second section to take down its signals at D, the following sections must understand that they are thereby made void at D and must not advance beyond such point without train order authority to do so. It would have been better if the code had stated that the following sections could again be created from D by train order, as, in reading the instructions one gets the impression that this must not be done. The plan of instructing a train to take down its signals, instead of sending an order that might be misunderstood, as was provided by the old code, is very good, but it would seem that such sections as are withdrawn should have their running orders annulled or be more explicitly deprived of their authority to run as a train.

In Example 9 too much dependence for safety is placed upon the crews addressed. It is sometimes very necessary to authorize a fourth section to pass the other three and run as first, but the example does not clearly provide for such a movement. In cases of this kind nothing should be left to the imagination of the men as to signals, identity, or any orders the several sections may hold. The running orders should be annulled, instructions given as to how many sections there shall be under the new creation, and if one engine is to pass another, so direct in the order. If there be other orders in effect for such sections they must be renewed. I know of no other way to fully protect this somewhat unusual movement.

The phrase, "The character of a train for which signals are displayed may be stated," would be better made to read, "The character of sections may be stated." It may be desired to specify the character of the section which is displaying the signals, instead of the section for which they are displayed.

Form H is the best practice, but in Example 6 the words "against other trains" in the third line from the bottom of the third paragraph of the explanation should be changed to read "is protecting against them." The paragraph of the instructions, stating that the working limits should be as short as practicable, is of no value. On Sunday, a work train is sometimes given a working order covering an entire branch. It is practicable to keep the operators on duty and extend the working limits from station to station, but this is unnecessary. Matters of this kind must be regulated by the kind of work and number of trains. Work trains should not be delayed getting new working orders every hour or so, when it can be avoided.

As it is sometimes desirable to use the other form of working order, requiring the despatcher to instruct work trains to protect against extra trains, instead of allowing the rules to so prescribe, I suggest such a form below.

Form K would have been strengthened if the day of the week had been added. Often men know that it is Sunday without knowing it is the 24th of June. There is another way in which an annulment order can be made more satisfactory: The despatcher should when possible say that the train has arrived at the station and is annulled beyond. This, of course, refers to cases where a train is annulled from some intermediate station not provided with a train register. Should a section be annulled, the annulling order should state that such section had arrived with no signals.

The 19 and 31 forms do not provide enough space for the address. It is not uncommon to address an order to several trains in different directions. The line in the clearance card reading, "This does not affect any orders you may have received," only serves to confuse and provoke argument and should be omitted. The train may have received orders before arriving at the station where the clearance is handed to it, and may be given orders with such clearance.

In the explanation of the cut which shows red lights to the rear of trains running by night, may be found the words "Rear of train by night while running." As the rear must be thus protected while the train is on a single main track, either standing or running, the explanation should read "Rear of train by night while on main track."

The number of minutes that trains should clear as shown by the train order examples in the summary should of course be changed to harmonize with whatever may be decided upon as to such rules as 88, 89, 91, etc.

SUMMARY.

Standard Time.

2. Watches that have been examined and certified to by a designated inspector must be used by conductors, enginemen, brakemen, firemen, train despatchers, operators and ———.

The certificate in prescribed form must be renewed and filed with the Superintendent semi-annually.

Conductors, enginemen, brakemen and firemen must report to an inspector semi-monthly, to have the performance of their watches recorded on form provided.

3. Conductors and enginemen who have access to a clock designated as a Standard Clock must compare their watches with it before starting on each trip. If they have not access to a Standard Clock, they must compare watches daily with those of conductors or enginemen who have Standard Time.

Conductors must compare time with enginemen before starting on each trip, and with brakemen and flagmen as soon thereafter as practicable. Enginemen must compare with firemen before starting.

Time-Tables.

4. Each time-table, from the moment it takes effect, supersedes the preceding time-table, and its schedules take effect on each division at the leaving time of such schedules at their initial stations on such division. But when a schedule of the old time-table corresponds in number and day of leaving with a schedule of the new time-table, a train represented on the old time-table will retain its train orders and assume the schedule of the corresponding number and date of the new time-table.

Schedules on each division date from their initial stations on such division.

Not more than one schedule of the same number and day shall be in effect on any division.

6 (*a*). Superintendents must require all concerned to acknowledge receipt of new time-table. Notice thereof must be bulletined at least forty-eight hours prior to its taking effect.

Signal Rules.

7. Employees whose duties require them to give signals must provide themselves with the proper appliances, and keep them in good order and ready for immediate use.

11. A fusee burning red must not be passed until burned out; while burning green, it is a caution signal. Fusees must not be placed on the track, or where fire may be communicated by them.

Add to Rule 12: Hand and lamp signals must be given in a plain and accurate manner. If slow movement is desired, signal slowly.

Add to Rule 14: Should a train fail to answer the 14 (*k*) signal, the train displaying such signal must stop and notify it. In stopping, consider following sections. Failure to acknowledge the signal must be reported.

15. The explosion of one torpedo is a signal to stop; the explosion of two, not more than two rail lengths apart, is a signal to reduce speed, and look out for a stop signal.

Torpedoes must not be placed near stations or crossings where persons might be injured by them.

Train Signals.

17. The head-light must be displayed at the front of every train by night, but must be concealed when a train turns out to meet another and has stopped clear of main track, or is standing to meet trains at the end of double track or at junctions.

When a train has cleared the main track, a stop-signal may be given to the engineman from the rear by a green lamp.

18. Yard engines will display the head-light at the front and rear by night. When not provided with a headlight at the rear, two white lights must be displayed. Yard engines will not display markers.

By night a red light must be displayed to rear on tenders of road engines being moved between trains and roundhouse.

19. The following signals will be displayed, one on each side of the rear of every train, as markers to indicate the rear of the train: By day, green flags; by night, green lights to the front and side and red lights to the rear, except when the train turns out to be passed by another and is clear of main track, when green lights must be displayed to the front, side and rear.

24. When cars are pushed by an engine, except when shifting or making up trains in yards, a flagman must take a conspicuous position on the front of the leading car. By night, a white light must also be displayed on the front of the leading car.

Cars must not be backed or cut loose and allowed to run over a street, highway or private crossing, in yards or elsewhere, without a flagman on the front of or preceding the leading car.

25. On all trains that carry passengers each car must be connected with the engine by a communicating signal appliance.

26. A blue flag by day and a blue light by night, displayed at one or both ends of an engine, car or train, indicates that workmen are under or about it; when thus protected it must not be coupled to or moved. Workmen will display the blue signals, and the same workmen are alone authorized to remove them. Other cars must not be placed on the same track so as to obstruct the view of the blue signals, without first notifying the workmen.

(To be continued.)

The French railroads in 1905, working on the average 24,644 miles of road, earned on the average $12,313 per mile, which was 3⅓ per cent. more than in 1904. Of the seven great systems, the Northern had much the heaviest earnings, viz., $20,987 per mile, followed by the Paris, Lyons & Mediterranean with $15,643, while the State system earned but $5,718 per mile. These are all large systems, and the six great companies have each some very productive lines and many branches with a very thin traffic. The Paris Interior Belt railroad, which unites the five lines entering the city with each other, and serves as a transfer line, earned no less than $98,017 per mile; but there are only 20 miles of it. The Paris, Lyons & Mediterranean, the greatest French system, worked 5,828 miles of railroad. All but one of the French systems, the Southern, have a terminus in Paris.

Protecting Piles from the Teredo.

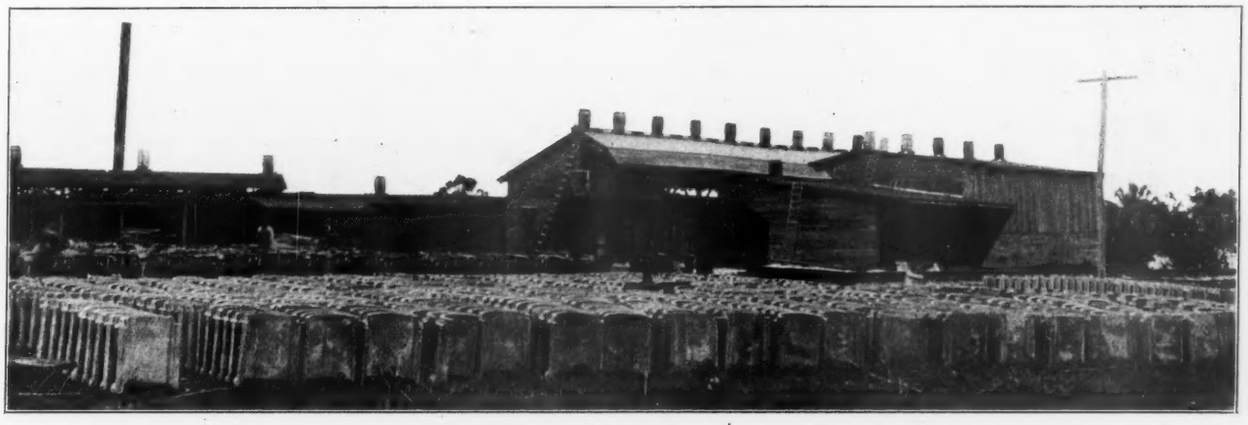
The teredo works along practically the whole coast of the United States, but does the most damage in the southern portion, especially in the Gulf of Mexico and along the whole of the Pacific coast, reaching its worst form in Puget Sound, where there is a combination of limnoria and teredo. In the Gulf of Mexico the worms will honeycomb a green pile and render it useless, as far as construction purposes are concerned, in from 10 months to 2½ years; whereas green piles on the Pacific coast cannot really be counted on to stand longer than 10 months.

The teredo, when it enters a pile, is almost microscopic in size, and leaves a hole in the outside of the pile no larger than a pin head. As soon as it attaches itself to the wood, it immediately begins to burrow and grows very fast. Piles that have only been in the water from two to three years in Florida have been split open and teredo ranging from ¼ in. in length to 20 in. in length have been found, reaching a diameter of ⅜ in.

The work of the teredo impresses the observer as being all the more remarkable after he has seen one. In color they resemble the light colored jelly fish, and are of slightly denser consistency than a jelly fish. They grow as fast as they bore, and at the further end of their furrow are two shells with which they do their destructive work. It is necessary for the teredo to have free access to clean water at all times, and, strange to say, it is not believed that they live on the wood that they cut, but take their food from the water outside. They have two siphons extending out of the wood into the water; one of them serves to take in food, and the other to take off the refuse from their bodies, including the wood which they bore.

Owing to the great amount of destruction wrought by these sea worms many methods of protection have been devised. Most of these methods are concerned with treating exposed wood with chemicals. Creosote has been found the most practical and most efficient for this purpose of all chemicals, but it has been demonstrated beyond doubt that creosote is not permanent in its protection. In Cuba, for example, creosoted piles have been rendered almost useless in 2 to 2½ years. On the Pacific coast similarly treated piles have been rendered useless in 15 months; a great difficulty with creosote being that it is impossible to tell the life of a pile without trying it, and in many localities piles near each other have been attacked in entirely different ways, some lasting only a very short time and some lasting a comparatively long time.

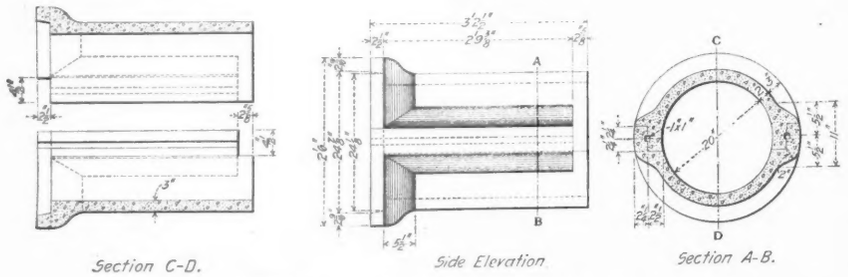
The Louisville & Nashville Railroad about 12 years ago used vitrified clay pipe and filled the annular space between the pipe and the pile with sand. This method of protection was found to be efficient, except that it was very difficult to put whole sewer pipe on a pile after the bridge had been built. In order to do this,



Concrete Pipe Made and Stored near the Bridge.

Piles Protected from Teredo with Sectional Concrete Pipe, Seaboard Air Line.

it was necessary to remove the caps of the structure. This, of course, ran the expense up. In order to avoid this, the company used split sewer pipe with ordinary butt joints and wired the sections together around piles. The annular space was then filled with sand, the same as with the whole pipe, but it was found that the joints could not be made tight enough to hold sand. Then the space was filled with concrete. This was very effective for a while, but as soon as the currents and tide caused a scour at the mud line the teredo attacked the pile there. In many cases where this protection was used, piles had been eaten away at the mud line,



Elevation and Sections of Concrete Pipe.

and they actually hung to the caps. The trouble with this protection is that the concrete filling makes the pipe and pile adhere. When the scour occurs at the mud line, the pipe is unable to settle, and, therefore, does not protect the pile at a very vulnerable point.

A recently devised pipe, designed by Mr. Philip Aylett, has been put on the market by the Lock Joint Pipe Company, 346 Broadway, New York; for pile protection. This pipe is made of cement, and divided longitudinally into halves, with keyways in each section which, when placed around a pile and keyed, form a scarf joint. This pipe is made in sections of 2 ft. and 3 ft. long, and the diameter varies according to the size of the pile. The pipe is placed around the pile at the top of the water, and section by section lowered until it rests on the bottom. The pipe is then allowed to settle a few inches and the annular space between the pipe and the pile is filled with sand.

For a 12 in. pile an 18 in. pipe is used, leaving a space all around the pile of 3 in. for the sand. For piles above 12 in., 20-in. pipe is used. The 18-in. pipe is 1¾ in. thick and the 20-in. pipe 2 in. thick.

After the pipe has been filled with sand and allowed to settle, the tops of the pipes are sealed. The teredo has never been known to work below the mud line, and this is the principle upon which the lock joint pipe works. By placing the pipe around the pile and keying it, extending from below the mud line to above high water, it more than covers the entire field of work of the teredo, and the fact that the pipe is filled with sand accomplishes the result, as far as the teredo is concerned, of raising the mud line above high water. Piles which have been infested with the teredo and have been protected with lock joint pipe as above have been pulled up after three days, and all the teredo in them have been found to be dead.

This pipe is manufactured on the ground, the company shipping cast-iron moulds and employing labor and materials as near as possible to the site of the work. This saves freight and breakage in transit.

The accompanying cuts show the Seaboard Air Line bridge across Manatee river, Fla., protected with lock joint pipe, and a quantity of pipe stacked up ready to be put on the bridge. The blueprint shows the standard 20-in. pipe. This pipe is keyed with a wooden key and hot tar poured on top of this key so that it goes down through the whole keyway and makes the joint absolutely tight. Tar is also used in the bell and spigot joints.

This same pipe is used for culverts and sewers, and in this construction is laid with broken joints, thereby making a very strong pipe. Instead of the keyways being filled with wood, for sewer purposes a plastic cement key, re-enforced, is used.

Curve Resistance.

BY WILLIAM G. RAYMOND,
Dean, College of Applied Science, State University of Iowa.

No entirely satisfactory theoretical discussion of curve resistance has been published. Perhaps none is possible. Experiments have been made showing that with high degree curves the resistance is about 0.4 lbs. per ton per degree for American bogie trucks of about 5 ft. wheel base at slow speed; that it is considerable more than this for curves of small degree and long rigid wheel base, even reaching 1.5 lbs. per ton per degree. The usual allowance made by locating engineers in America is from 0.8 of a pound to one pound per ton per degree. This is perhaps not much too large for low degree curves, is certainly not too large for a long wheel base on a curve of low degree, but is too large for 5 or 6-ft. trucks on sharp curves. Observation has seemed to show that the resistance per degree is greater on flat curves than on sharp curves. An attempt will be made to discuss the action of a truck on a curve, and to develop a rational theory for curve resistance that shall agree with observation.

The fit of a new wheel and rail is shown in Fig. 1. It is usually said that there is ⅜ of an inch play allowed between the gage side of the rails and the flanges of the wheels. The gage side of the rail is a definite vertical surface, but the corresponding gage point of the wheel is an arbitrary point on the fillet curve between tread and flange, and a vertical line through this point falls 3/16 of an inch inside the gage side of the rail when a pair of wheels is centered on the track. Owing to the coning of the wheel and the 12-in. curve of the rail top, the wheel bears on the rail as indicated in the figure, and if moved over toward the rail about 3/32 of an inch, a point in the fillet curve would come into bearing well up on the top of the corner curve of the rail. If the wheel be moved still farther toward the rail until the 3/16 in. play is used up, then the wheel would be lifted about 1/16 in. off the rail top and would be bearing at about the points P and P¹ in the figure. It is doubtful if the gage point in the flange of a new wheel ever comes into bearing on a new rail. With a worn wheel and rail, a very considerable portion of the flange may be bearing on the rail. The forward outside wheel of a truck rounding a curve bears against the outside rail, but the foregoing discussion will show the practical difficulty of determining the point of bearing. The irregularities of track, variable condition of rail

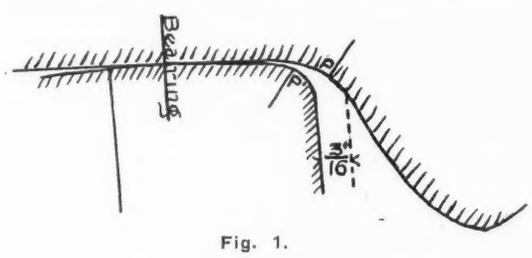


Fig. 1.

and wheel as to wear, and unknown small forces, produce irregularities in the bearing point. The bearing of a wheel on a rail is not in a point or line but in a surface, due to the compressibility of the materials. This surface is small and of irregular shape and variable in size with conditions and characteristics of the materials. As an average the surface does not exceed in area the area

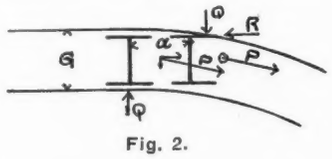


Fig. 2.

of a circle of ⅜ in. diameter, possibly somewhat larger under engine drivers.

Action of a Truck on a Curve.—Let a four-wheel truck of length a between axles be considered. The truck pulled by the force P, Fig. 2, acting at the center point approaches the curve. So soon as the drawbar reaches the curve the direction of pull P changes

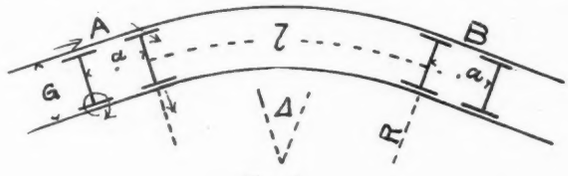


Fig. 3.

to a tangent to the curve at the drawbar. The truck rolls straight ahead, however, until the forward outer flange comes against the outer rail, when the resistance R with an equal force, component of P, at the center pin tends to skew the truck across the track and bring the rear inner wheel against the inner rail. How far over the inner wheel is drawn may not be known; apparently the flange does not wear against the side of the rail. The twisting

movement is resisted by the normal pressures Q. If the truck is short, and the degree of curve small, the whole truck will be on the curve before the outer rail bears on the outer front flange, but if the truck be long, or the curve sharp, the forward wheel will strike the outer rail while the rear wheels are still on the tangent. Assuming that the whole gage play is used up in skewing the truck, and that it varies from $^{3}/_{16}$ in. to $^{3}/_{8}$ in., the angle between the rail and forward wheel will be from 0 deg. 12 min. to 0 deg. 24 min. when a 5-ft. truck is wholly on a 1 deg. curve; about twice these values for a 10 deg. curve, and three times for a 20 deg. curve. The rear axle should stand radial when the angle subtended by a chord of twice the wheel base is sufficient to give a middle ordinate of the gage play at the outer rail, and both outer wheels should bind on the outer rail—the axle of the truck being then a chord to the curve—when the angle subtended by a chord of the wheel base gives a middle ordinate equal to the gage play.

The front and rear trucks probably do not act alike, since the forces applied to their respective center pins probably make different angles with the truck axes. The forward truck only will be considered, and the rear truck assumed to produce an equal resistance. As the truck is advanced by the pull P, it must be turned about some center through the central angle of the curve traversed. It makes no difference what that center is so far as the result of the discussion is concerned, and it will be assumed to be the rear inner wheel. Of course it is the center pin about which the truck turns, but at any instant the center may be assumed to be the rear inner wheel since the center pin is moving with the truck.

If there is no friction between wheel and rail, and if the speed through the curve is that for which the track is canted, there will be no curve resistance, since the canting of the track would counteract the centrifugal force and the truck would roll and slide around the curve. But there is friction, and the truck must be twisted against this friction. This twisting with the losses in transmitting mechanism causes curve resistance.

Theory of Curve Resistance.—Curve resistance arises from the slipping of the wheels on the rails. The total slipping from any curve is that due to twisting the truck through an angle equal to the change in direction, i.e., the central angle of the curve. This will produce longitudinal slipping equal to the difference in lengths of the inner and outer rail and the curve, and a lateral slipping depending on the length of the wheel base and the central angle of the curve, and independent of the length of the curve.

In moving from A to B, Fig. 3, the truck frame must move longitudinally through the distance l + a (a may be neglected), and must twist through the angle $\triangle$. If it be considered to be at every instant revolving about its rear inner wheel, the rear outer wheel will be sliding longitudinally with reference to the track, the forward outer wheel both longitudinally and laterally (diagonally), and the forward inner wheel only laterally. The rear inner wheel will be twisting on its rail. The force directly responsible for turning the truck is the pressure of the outer rail against the front outer wheel flange, and this force is induced by the pull on the drawbar. What has preceded concerning the fit of wheel and rail, the uncertain gage play, and irregularities of track conditions, will make evident the great difficulty, not to say impossibility, of completely analyzing and following all the forces involved to the final force at the drawbar which may be called curve resistance. The principle of equal work will therefore be used, the work done in sliding the wheels being placed equal to the work done in overcoming curve resistance through the length of the curve, and that resistance determined.

In radians the angle $\triangle = \frac{l}{R}$ and any point moving through an equal angle with a radius of r will move through an arc of $r\frac{l}{R}$. The two outer wheels will therefore slip longitudinally through an arc of $G\frac{l}{R}$, which is the difference in length of the two rails, and the two forward wheels will slip through an arc of $a\frac{l}{R}$. One-half the weight of truck and load, therefore, slips $G\frac{l}{R}$ feet, and one-half slips $a\frac{l}{R}$ feet. The resistance to slipping is the weight slipped times the coefficient of friction. The coefficient of friction is probably never greater than ¼ in., nor less than $^{15}/_{100}$, and may fairly be taken at ⅛ as an average. For each ton of weight, therefore, a half ton times f, the coefficient of friction, will be the resistance to both longitudinal and lateral slipping, and work being force times distance, the work done in sliding the wheels will be for each ton of 2,000 lbs.

$$1000 \times f \times (G + a\frac{l}{R},$$

If x be the curve resistance at the drawbar due to this sliding, the work done by x in the length l is x × l. Equating these two expressions for work, and solving for x

$$x = \frac{1000\,f\,(G + a)}{R}$$

If $\frac{5730}{D}$ be substituted for R

$$x = \frac{1000\,f\,(G + a)\,D}{5730}.$$

The twisting of the rear inner wheel will increase the work done by perhaps $^{1}/_{40}$ of one per cent., and is neglected.

The distance across the track between wheel bearings which must be used for G is probably 4.73 ft. Using this value and ⅛ for f,

$$x = (0.165 + .035\ a)\ D.$$

If a be 5 ft. x is 0.34D.

But this is not the whole of curve resistance. It is the whole except that due to the friction of what may be called the transmitting mechanism between wheel and drawbar. This friction is practically all at the bearing of flange and rail. The pressure of the flange against the rail is essentially constant and just sufficient to slide the three wheels and hoist the fourth. With the lever arms of these wheels considered, using ⅛ as the coefficient of sliding friction, the pressure will probably vary with the wheel base, and may be from 220 lbs. to 250 lbs. per ton of total load, the smaller pressure for a 20-ft. wheel base. This pressure times some coefficient of friction is a force to be overcome. The sliding here is not longitudinal along the rail, but is vertical, grinding down the corner or side of the rail. Just how much the sliding is cannot be told, but it occurs at a point a little in advance of a vertical through the center of the wheel, and the resisting force may be said to act with a lever arm of this slight advance, and to be overcome by a force acting at the center of the wheel, which force would be almost equivalent to that portion of curve resistance due to this cause. The lever arm of the frictional resistance cannot be exactly determined, nor will it be always the same. It is probably not less than ⅛ in., nor more than ¼ in. with 33-in. wheels. If it is assumed to be $^{3}/_{16}$, and the coefficient of friction be assumed at $^{12}/_{100}$—the slipping is much faster than that across the rail and hence a smaller coefficient should be used—the resulting curve resistance due to this flange friction may be from 0.41 lbs. per ton for a 5-ft. wheel base to 0.38 lbs. per ton for a 20-ft. wheel base. It will be observed that this resistance is independent of the degree of the curve. What may be considered equivalent to an increase of the friction coefficient will probably result from an increase of the angle between wheel and rail. It has been stated that this angle for a 10 deg. curve is about twice that for a 1 deg. curve. If it be estimated that the friction is increased in proportion to the increase in this angle, and the value $^{15}/_{100}$ be used for 1 deg. curves, then for any curve this item of resistance is given by

$$y \text{ for 5-ft. truck} = .41 + .041D.$$
$$y \text{ for 20-ft. truck} = .38 + .038D.$$

In view of the very considerable element of uncertainty in the friction coefficient, and the lever arms of the forces, it will be sufficient to say that for all trucks

$$y = 0.4 + .04D.$$

Summing the two items of curve resistance developed, there results for curve resistance in pounds per ton of total load,

$$R_c = x + y = 0.4 + (0.205 + .035a)\ D\ (A).$$

For several round number wheel bases, closely approximating standard practice, the resistance would be:

Wheel base, feet.	Resistance, pounds per ton.
5	0.4 + 0.380D
6	0.4 + 0.415D
7	0.4 + 0.460D
8	0.4 + 0.485D
9	0.4 + 0.520D
12	0.4 + 0.625D
13	0.4 + 0.660D
15	0.4 + 0.730D
16	0.4 + 0.765D
20	0.4 + 0.905D

The materially greater resistance of locomotives is seen from this table. It will also be seen from the introduction of the constant term that the resistance per degree is less with sharp than with flat curves.

The formulas omit any increase due to obliquity of traction because there is no such increase from one car to another. It is true that the axes of coupled cars do not lie in the same line, but the junction points of both couplers are moving in the same line which at any instant is a tangent to a curve concentric with the track curve and of slightly greater radius. The pull and resistance here, therefore, are in this tangent line. It is true that this pull acting at the following center pin is not in the line of action of the resistance at the wheel, but this has been considered in the first item of resistance in the equation of work from which the tangential pull was derived, and in the second is presumably included in the friction allowance, which increases with the degree of the curve. The larger wheels of the locomotive probably do not reduce the second item of resistance because it is probable that both lever arms are increased in the same ratio.

It is probable that the results of the formulas should be somewhat increased for very slow velocities, and possibly diminished for very high velocities, since the coefficient of sliding friction varies with the velocity of sliding. The sliding represented by the x

term varies in speed with the speed of angular motion, and at a constant speed through the curve, is ten times as fast for a 10 deg. curve as for a 1 deg. curve, and it also varies with the speed through the curve. But its greatest speed is so slow that there is probably not much decrease in friction for any ordinary speed. For high speed passenger trains it may be worth while to affect the formulas given by a coefficient for variation in speed, and the following form is suggested, C being the parenthesis of equation (A) and S the speed in miles per hour.

$$R_c \text{ (passenger trains)} = (0.4 + C\ D)\left(1 - \frac{S - 20}{200}\right).$$

While the resistance doubtless varies with all trains and with all speed, the variation is thought to be too uncertain to warrant any alteration of the formula for freight trains.

The foregoing seems to give results more nearly agreeing with practice than any published discussion with which the writer is familiar. It agrees with observations both with American bogie trucks and with foreign long rigid wheel bases. It does not agree with the observations of the late Mr. Morley, who thought that he had noticed that the amount of curve compensation was dependent on the rate of the ruling grade, and should be greater as the ruling grade was less. He reasoned that this was because of the longer train handled, seemingly proving experimentally that there is a resistance due to the obliquity of traction. While the writer has no knowledge of the curves on which these observations were made, he thinks that it is reasonable to assume that the curves were flatter on the low grade lines than on the high grade lines, and the foregoing discussion shows that if this were true a larger compensation would appear necessary on the low grade lines. The discussion indicates that curve compensation of 0.04 per degree should be made for 1 deg. curves; about 0.03 per degree for curves of from 2 to 5 degs., and about 0.025 per deg. for curves sharper than 5 degs. While these figures are less than the usual allowances, they seem to be all that such experiments as have been made warrant.

Of course where saving of elevation is of no consequence, a high rate of compensation may be used to cover all uncertainties, but where it is necessary to save every possible foot, as in long developed lines over very high summits, it is believed the values here given may be used with reasonable certainty that trains will be no more likely to stall on curves than they would on steeper grades made necessary by high rate of compensation.

Early Wooden Railways.

BY W. B. PALEY.

It is not known with any certainty when the first pair of parallel tracks for wheeled traffic was laid down in Great Britain, or whether it was of wood or of stone. Perhaps the former is the more probable, the material being found everywhere and its long shape being much more suggestive of fitness for such a purpose than stone. But so long as each neighborhood produced everything it wanted such things were not needed. At last the destruction of timber near London made the use of coal indispensable. This could only be conveyed by sea, and one of the few places where it could be got with the limited appliances and skill of those days was the valley of the Tyne, just above and below Newcastle. About 300 years ago a considerable trade in coal for shipment began there, which soon led to difficulties as to getting it from the mines into the boats. The distances were small, but the art of road-making had died out and in bad weather pack-horses could not carry enough to render their use profitable. Some unknown benefactor to his species at last laid down two parallel lines of timber for carts to run on. Probably they were merely stout planks at first, but the sinking at the joints would soon suggest that other planks should be placed under them, the structure then becoming fairly efficient. When flanges, either on the wheels or the rails, were first invented, or by whom, is not known, but it was apparently towards the end of the seventeenth century. These wooden railroads seem to have survived throughout the greater part of the following century, and even into the nineteenth in some cases. The Middleton colliery railroad at Leeds, for instance, was of wood until it was re-laid for the use of Blenkinsop's rack-rail engines. These were started in 1812 and were unquestionably the first commercially successful locomotives. Many other wooden railroads had existed in the same neighborhood for 50 or 60 years previously, and no doubt in other colliery districts as well. One was laid down near Sheffield, for instance, so early as about 1712, from the Duke of Norfolk's colliery at The Manor into the town, nearly 1½ miles down hill. It lasted till 1775, when it was destroyed in a riot. Next year it was reconstructed with the first cast-iron flanged rails of the well-known ⌟ L type by James Outram, their inventor. A wooden railroad of particular interest long existed at Bath. It was laid down in 1731 by Ralph Allen, who having gained a fortune by post-office contracts, acquired and developed extensive quarries of the celebrated Bath oolite stone on Combe Down. These being at a great height, and away from any regular mode of transit, it became necessary to devise a means of bringing down such a heavy material. The wooden railroad occupied the site of what is now called Prior Park Road and was laid partly upon low walls and partly on the ground, "like the wagonways belonging to the collieries in the north of England." It is stated to have been a great improvement upon these and must certainly have been pretty massive to stand the brake power necessary for bringing loads down so steep an incline. Distinct marks of old tramways may still be seen up on Combe Down, but of the "main line" nothing is traceable. Looking down Prior Park Road, however, its straightness is very suggestive of an inclined railroad. At the bottom also it keeps straight on, but the gradient eases greatly. The tram road ended on the bank of the River Avon, about where the Kennet Avon Canal now enters. As the canal was finished in 1810 the tramway must have been extinguished, either then or before, but it was in use in 1776 and is not mentioned in the canal company's first act, 1794. That period comprised the palmy days of beautiful Bath, when it basked in the sunshine of royal and aristocratic favor, and nearly all the splendid streets, squares and crescents designed by the two Woods are built of stone brought down by Ralph Allen's wooden tramway.

The trucks used upon it ran on four cast-iron wheels, about 20 in. in diameter, with very broad treads, and flanges said to have been no less than 6 in. deep. The floor was of stout oak planks, 3½ ft. wide by 13 ft. long, and furnished with several transverse rollers for the convenience of arranging the loads. Removable sides could be fitted. Tremendous brake-power being necessary, the brake levers for the hind wheels were drawn down by ropes and small iron rollers at the back of the wagon, each turned by a bar inserted in a series of holes. A hatchet and pawl prevented them from flying back and afforded great facility for unlocking. The brake levers, with the blocks attached to them, were called "jigg poles"; they merely hitched into a loop on the end of a cross-piece and could be taken off to permit of loading or unloading. The fore wheels were locked or spragged, by means of thick square iron bolts, one to each wheel, attached just above the axle to the cross-beam which carried the axle bearings. These bolts were worked by bell cranks, moved by rods under the truck and attached behind to the lower ends of two upright iron levers. These were pivoted on a short shaft placed across the two center longitudinals or soles, and when out of use were kept upright by a loop and ring at the top of the wagon end. To lock the front wheels it was only necessary to take off the ring and pull down the levers, which shot the bolts between the spokes. In this way any one or all the wheels could be braked, but it could only be done from behind, where the brakeman could not get knocked down and run over. The most remarkable peculiarity, however, about these wagons was that one wheel on each side ran loose upon the axle and one turned with it, having a square seat. Linch pins were used at both ends of the axles. The bearings were brass collars fixed in stout cross beams. Springs, of course, were not dreamed of. It required two horses to pull an empty truck back, the line rising nearly 500 ft. in its total length of 1½ miles. In fact, most of the rise is in little more than a mile, equal to a gradient of perhaps 1 in 12 or 1 in 14. Only a single track was laid. A large trade was done on it for many years, for besides the great consumption of stone in Bath itself, the Avon had just before been made navigable down to Bristol, whence the stone was shipped round to London and other places. The trucks often carried about four tons of stone, under which they must have bumped along violently unless the line was kept in very good order. Doubtless the 6-in. flanges were found quite necessary.

The colliery lines about Newcastle used, in the eighteenth century, rails of beech wood, carefully planed on the top and pegged down to cross pieces, which were even then termed "sleepers." Longitudinal timbers in addition were sometimes used, the extra height being of use in enabling the cross sleepers to be well covered up and protected from the action of the horses' feet. There were usuallly two lines of rail, the descending one being called the main-way, the other the bye-way. The cars held a Newcastle chaldron, or 53 hundredweight, 5,936 lbs. They were built of fir planks, strengthened with iron straps, and had oak or ash soles. They sloped forward, having slightly larger wheels at that end, which was found to ease the draught. These wheels were of cast-iron, the rear pair being made solid, of pieces of beech wood dovetailed and cramped together. It was supposed that brakes held better on wood than on iron. Some of these wooden lines ended in a short timber viaduct, where the land sloped much to the river, leading to a "staith" shipping quay, from which the coal could either be discharged at once down a chute into the "keel" or barge which carried it to the ships, or stored if no keels were at hand. The wagons opened below, to effect this.

In going down hill with a loaded wagon, the horse followed behind, so that he might not be knocked down if it got beyond control, which is said to have happened rather frequently. The drivers generally owned the horses, often of a miserable description; and were paid by the trip or "gait." One horse was used

to a wagon, which weighed, empty, about half a ton, 1,120 lbs. Most the Tyne-side wooden railroads were short, half a mile to a mile or so, but a few were somewhat longer. George Stephenson must have been perfectly familiar with these old timber lines, although their career was coming to an end when his was beginning. They were mostly replaced with cast-iron towards the end of the century. He was born in 1781.

Early Valve-Gears on the Pennsylvania Railroad.

BY C. H. CARUTHERS.

The Pennsylvania was probably the last American railroad to adopt the Stephenson link motion. This may have been owing to the well-known opposition of M. W. Baldwin to that form of valve gear and the preponderance of locomotives of his construction on the road during those early years.

The first locomotive equipment of the company consisted of six engines which were transferred to it from the Harrisburg & Lancaster Railroad on October 16th, 1849, that road having been leased by the Pennsylvania to enable it to form a connection with the Columbia & Philadelphia Railroad at Lancaster, Pa.

Figure 1 will convey a correct idea of the type of valve-gear

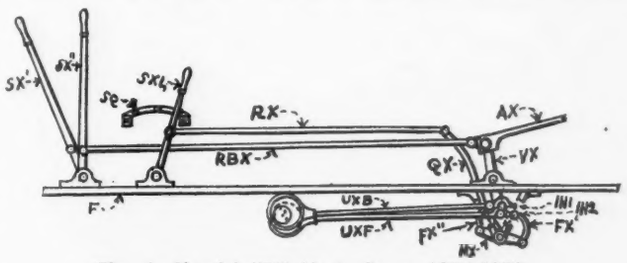


Fig. 1—Norris' "D" Hook Gear; 1838-1850.

used on these six engines, although about half of them were built by M. W. Baldwin and the other half by the Norrises. The drawing shows the Norris gear, but the Baldwin gear differed little from it. It was full-stroke only, with "D" hooks and no independent cut-off. Reference to the other drawings will show that its detail was closely followed in most of the full-stroke gears used previous to the adoption of link motion; in fact, the uniting of the eccentric rods to the arms of the reversing shaft by means of eye-bars or hangers was really a crude forerunner of the shifting link.

Figure 2 is drawn from a gear in which an independent half-stroke cut-off is used, the valve of which utilizes the horizontal partition plate which divides the steam chest into an upper and a lower story as a seat, this plate being provided with suitable ports. The cut-off eccentric was rigidly connected to the lower arm of the rocker-shaft, the hook being formed on the end of the valve-rod, and when not in use this was lifted from the pin of the upper arm of the rocker-shaft and held in the inverted V-shaped forging shown above it. Both this gear and the preceding used starting bars to insure proper engaging of the hooks, and also to work the valves independently of the eccentrics in shifting or making couplings. Three passenger engines of the Crampton type built by Baldwin in 1849 and 1850 for the company had this form of gear.

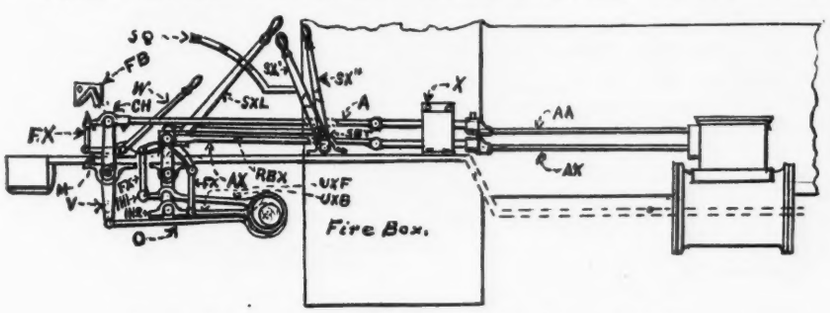


Fig. 2—Baldwin "D" Hook Gear on Crampton of 1849.

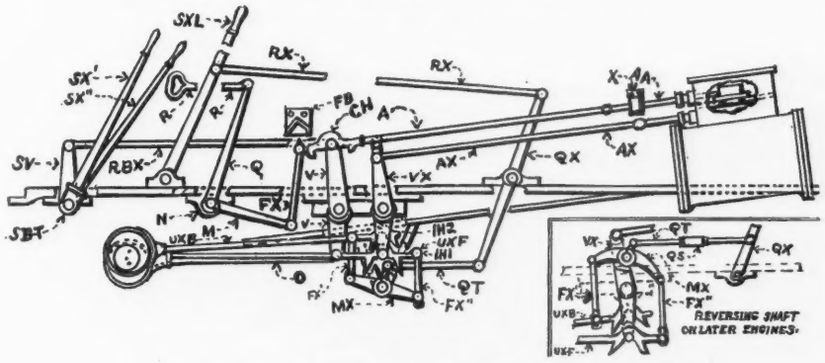


Fig. 3—M. W. Baldwin's "V" Hook Gear; 1850-1853.

The arrangement represented in Fig. 3 was first used on the ninth engine of the company's equipment, which came from the Baldwin Works the latter part of 1849. It will be observed that while the same general lines of Fig. 2 are followed, this type is arranged for use on engines with inclined cylinders and the eccentrics in front of the firebox. There were 23 more engines with this gear built during the next three years and added to the service, and these were followed by 12 large freight engines with a gear differing only in the position of the reversing shaft and its connections. This latter arrangement is shown separately at the right in Fig. 3. One of these 12 engines was sold to the state soon after coming on the road, but again came into the possession of the Pennsylvania with the rest of the state's equipment in 1857.

In Fig. 4 the full-stroke rocker shaft is made hollow, and thus forms the box for the cut-off rocker. This was done to enable the gear to be used on four eight-wheel connected Baldwin freight engines built for the Pennsylvania in 1850, which had the drivers placed so close together as to preclude the arrangement of rocker-shafts followed in Fig. 3.

Figures 5 and 6 are drawn from gears used on three engines fur-

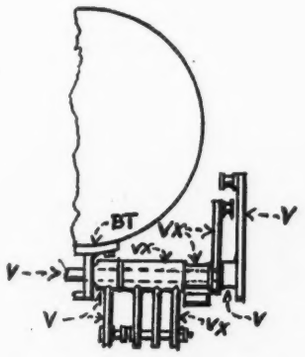


Fig. 4—M. W. Baldwin's Arrangement of Main Rocker Shaft Used as Box for Cut-Off Rocker Shaft; 1850.

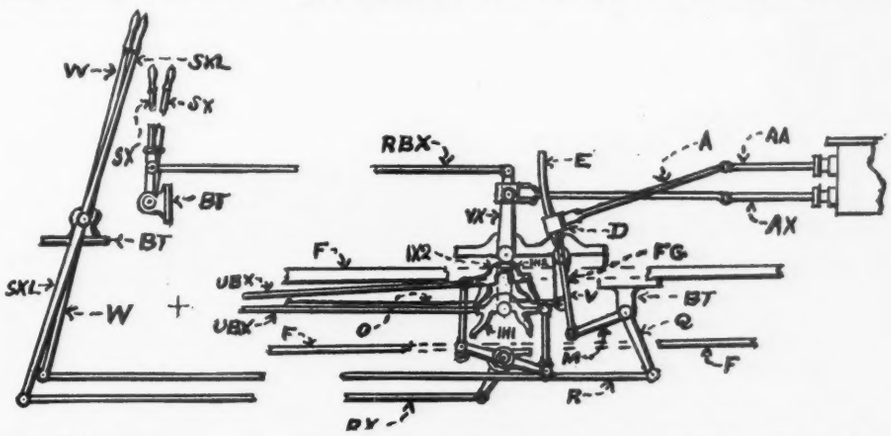


Fig. 5—Form of Cuyahoga Valve Gear Used on Two Seth Wilmarth Locomotives; 1852.

nished the company by Seth Wilmarth from his Union Works at Boston, Mass., in 1852 and 1853. That of Fig. 5 is an adaptation of the Cuyahoga gear, and was on the first two of the engines referred to, although it is probable that they originally used the gear of Fig. 6. It is not likely that two engines for passenger service would be built at the same shops with "V" hooks connected to the reversing shaft, a design much superior to the simpler but less reliable drop hooks, and then be followed by an engine with a device with not only the faults inherent in the drop hooks, but also the additional disadvantage of a cut-off working at only one point of the stroke. A good feature, however, of the gear shown in Fig. 6 is that but one lever was used in the cab to control both the full-stroke and the cut-off hooks, although separate valves were used. This type of gear was also used by the Hinkley people on engines built by them at that period. Incidentally, the writer saw the engine referred to, with the gear shown in Fig. 6. This gear was still in use just previous to its transfer to the Philadelphia & Erie division in the latter part of 1864.

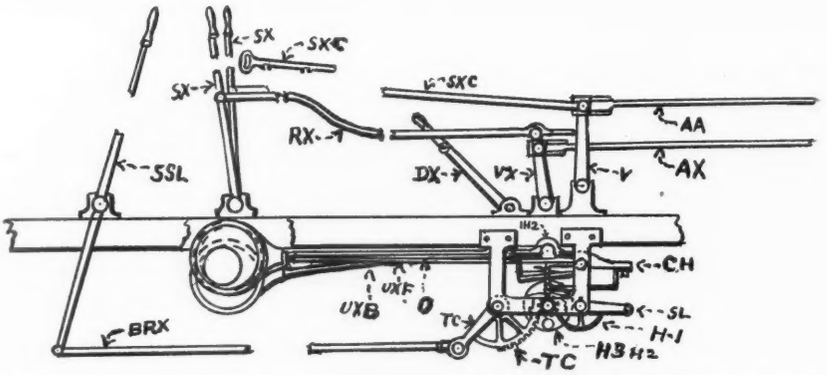


Fig. 6—Seth Wilmarth's "D" Hook Gear with Independent Half Stroke Cut-Off; 1852-1853.

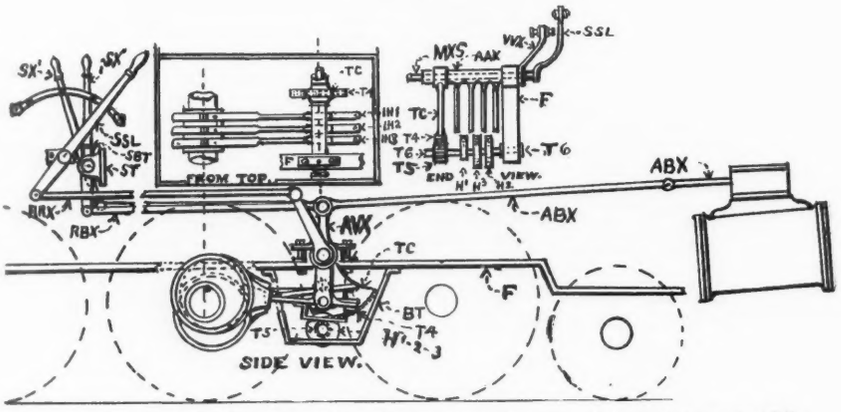


Fig. 7—Smith and Perkins Drop Hook Gear with Independent Half Stroke Cut-Off; 1853-1854.

Figure 7 shows a type of valve motion with some of the features of Fig. 6, namely, drop hooks of "D" pattern, "half moons" so placed on the secondary reversing shaft as to bring the hooks into position for full-stroke forward, full stroke backward, or half-stroke cut-off forward, as this shaft might be revolved by the toothed quadrant attached to the main reversing shaft and engaging with the spur wheel on the secondary shaft; and only one lever to control both full-stroke and cut-off hooks. In this gear the rocker-shaft was hollow and formed a box for the main reversing shaft, the toothed quadrant being attached to the shaft between the right and the left-hand rockers. Twelve locomotives with this gear came on the road in 1852 and the two following years, from the shops of the Virginia Locomotive Works, better known as Smith & Perkins, at Alexandria, Va. Doubtless the principal features of this form of valve-gear were suggested to Mr. Thatcher Perkins by that in use upon the Winans "Camel" engines, which is shown in Fig. 8. The Winans gear, it will be noted, has the main reversing shaft set behind the rockers, and connects to a toothed rack placed horizontally under the spur-wheel with which it engages. The chief difference consists in the use of heart-shaped cams to drive the cut-off hooks of the Winans engines. In practice these were found to be objectionable and were soon taken off and replaced by eccentrics. Both the Winans and the Perkins gear gave some trouble in snowy weather because snow became packed in the spaces between the cogs of the reversing gear and thus prevented proper handling of the hooks. The first "Camel" with the Winans gear furnished to the Pennsylvania came on the road in January, 1853, and was followed during the next three years by ten more of the same type.

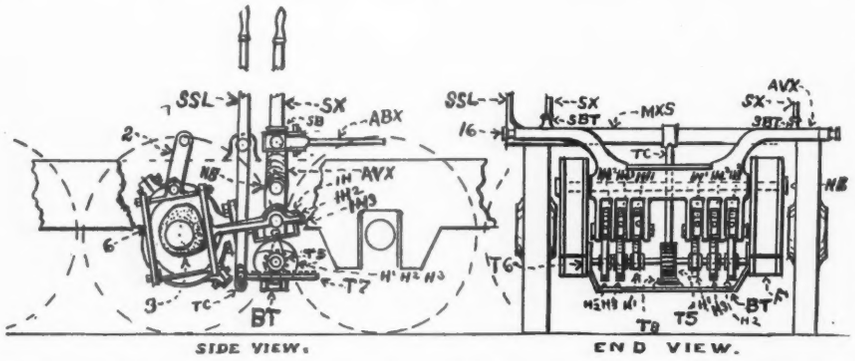


Fig. 8—Ross Winans' Drop-Hook Gear With Independent Half Stroke Cut-Off 1853-1856.

Figure 9 illustrates the improved form of R. Norris & Son's valve motion with "V" hooks and independent half-stroke cut-off, as it appeared on the fifty-fourth engine of the Pennsylvania, and on the next 21 Norris engines, whose numbers fell between 54 and 97, as well as on four built for the state, but which came into the company's possession by purchase in 1857. All of these 26 engines were built in 1853 and 1854. While the full-stroke features differ very little from those of Fig. 1, the cut-off differs from any yet referred to in having a double "V" hook on the end of the valve-stem. The upper part of this hook when lowered engages with the cut-off rocker, and when raised with a pin on the main or full-stroke rocker, and thus holds the valves together when working full. No partition is used in the steam chest, the full-stroke valve having the cut-off ports made in it, and its top serves as the seat for the cut-off valve.

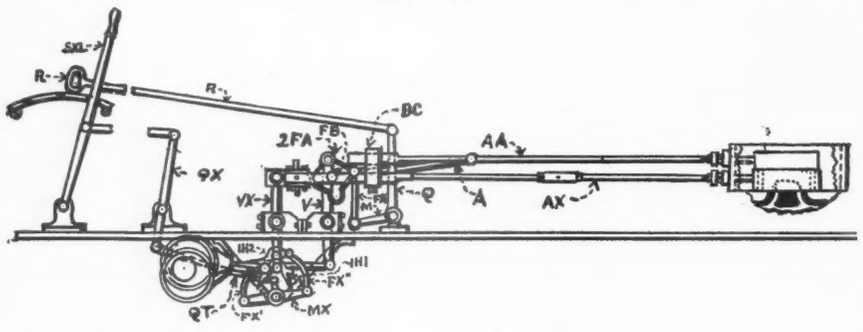


Fig. 9—R. Norris & Son's Valve Gear with Independent Half Stroke Cut-Off; 1853-1854.

This type of valve-gear and cut-off had been used by the Norrises for many years previous to the building of the 26 engines in 1853 and 1854, but the parts were somewhat

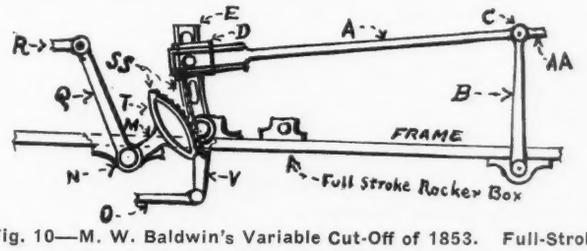


Fig. 10—M. W. Baldwin's Variable Cut-Off of 1853. Full-Stroke Gear (Not Shown) Same as in Later Form of Fig. 3.

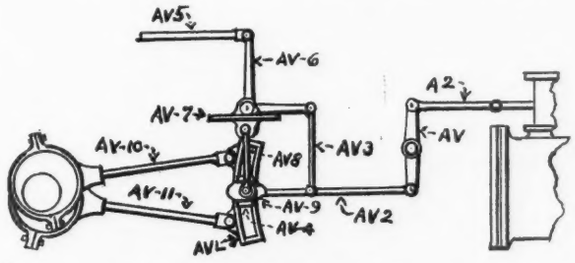


Fig. 11—Gooch Link as Used by Smith & Perkins; 1856-1857.

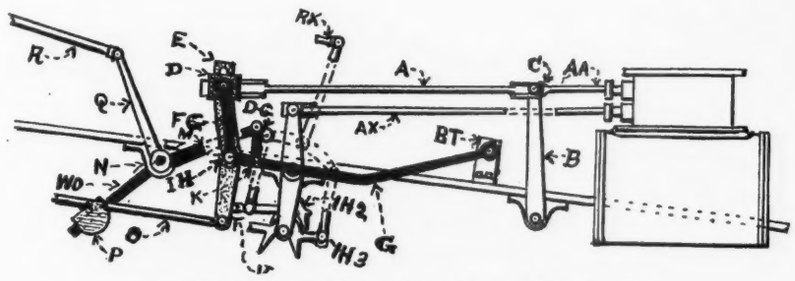


Fig. 12—M. W. Baldwin's Variable Cut-Off of 1857.

differently arranged. The company's ninth engine had this earlier form, and it was also thus used on 18 Norris engines built for the State railroads and bought by the Pennsylvania in 1857 with the other State engines already mentioned.

Somewhat later in 1853, the first Pennsylvania engine built with M. W. Baldwin's variable cut-off (Fig. 10) was put in service. Thirty-nine more followed during the ensuing three years, as well as six more originally built for the State. Two of the latter of the 39 used steel straps instead of the sprocket chains, to unite the quadrant and the sliding block, but the tendency of these straps to break soon caused them to be replaced by chains, as on the other engines of the type.

Early in 1856 the first engines with link motion entered the company's service. There were three, built by Smith & Perkins, and they had the Gooch, or suspended link, Fig. 11. Two years later these engines were transferred to the Steubenville & Indiana Railroad, now part of the Pittsburg, Cincinnati, Chicago & St. Louis. One of them was still in service in 1880 and retained the Gooch links. These were followed within a few months by two Norris passenger engines, each of which had Stephenson links, and early in 1857 four new Baldwin passenger engines on the road were fitted with similar valve gear.

Mr. Baldwin's antipathy to link-motion appears to have enabled him to follow these with four freight engines fitted with hooks and a new type of variable cut-off shown in Fig.12 , and also two shifting engines with hook-motion but no cut-off. Again in 1858, he furnished the company with four large eight-wheel connected freight engines for mountain service, each of which tried the patience of the enginemen with another style of cut-off in connection with their full-stroke "V" hooks. Figure 13 shows this cut-off to be of the variable type with many of the features common to those of Figs. 10 and 12, but having the block on the end of the valve-rod connected to the arm of the reversing shaft by two eye-bars through the medium of a second block sliding in a guide attached to the frame near the bottom of the lower arm of the rockershaft. These were the last engines built for the company with hook motion. All subsequent equipment had the Stephenson links until 1889, when the Webb Compound No. 1320 came from England with the Joy gear, and no change of consequence in valve gear was made after that time until the present experiments with the Walschaert link, which had proved so satisfactory in Continental Europe.

This article would be incomplete without mention of the gears of Figs. 14 and 15. That of Fig. 14 is a Baldwin idea in which a single eccentric is used for both back and forward motions, and that of Fig. 15 is novel in having a cut-off worked from the cross-head. It was the invention of one of the Norrises and was on two engines built by that firm in 1848 for the State. The Baldwin gear was also on an engine built for the State at a much earlier period. All three came to the Pennsylvania in 1857.

In conclusion, it may be mentioned that the link motion is shown by the preceding record to have been applied to all of the company's new engines built after 1858. About 1861, the substitution of links for hooks was begun on all of the older engines which came in for general repairs, and this was so thoroughly done that by 1868 only a few with the old types of valve gear were running, yet up to the latter part of 1874 two used in shifting service still retained the Smith & Perkins hooks. These were soon after retired and cut up—the last of the ancient valve-gear on the road.

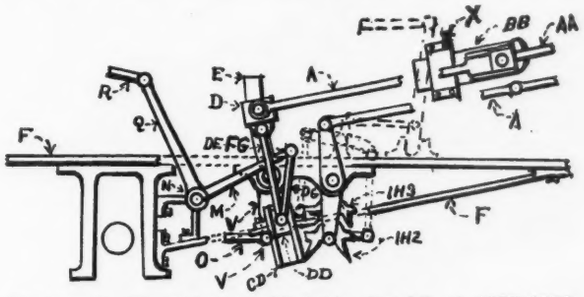


Fig.13—M. W. Baldwin's Variable Cut-Off of 1857-1858.

The Principle of Lubrication.

BY ERNEST J. M'VEIGH.
Storekeeper Grand Trunk Railway.

The question of lubrication is such a live one that this generation will not see the time when the last word has been said on the subject, but there has been so much said and written in this connection that to the average shop, car or engine man further discussion may seem unnecessary and altogether superfluous. Is it superfluous, and have railroad men generally been educated on this line to the point where there is nothing more to be learned? I thing not; in fact, I think the reverse is the case, and while the leaders have given the matter a great deal of careful attention and

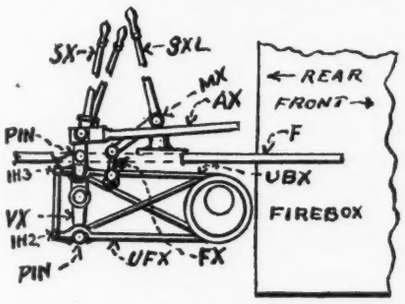


Fig. 14—M. W. Baldwin's Full Stroke Valve Gear with Single Eccentric; 1835.

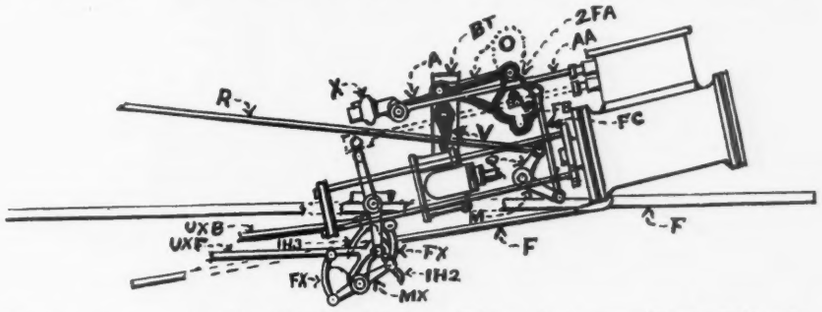


Fig. 15—Cut-Off Gear Driven from Cross-Head; Richard Norris, 1848.

study, the education of the rank and file has been to a great extent neglected, and abuses exist to-day that are supposed to have been eliminated many years ago.

To illustrate: Twenty-five years ago I came in contact with a shop foreman or leading fitter who was responsible for the bearings on the locomotives running on his division, and my first recollection of him was his coming to the stores for a box of brown soap to doctor a journal that was running hot. These things were new to me in those days and I was so interested in this new idea that I asked him a great many questions about it, and he, with a great many winks and sly nods, told me all about it, and how instead of going to considerable trouble to humor the old girl when there was really nothing the matter with her, he just slipped in five cents' worth of brown soap and fooled her.

I was younger in those days than I am now, and I thought him pretty cute, but I owe to him my first lesson in how *not* to lubricate an engine journal. I have known this same man ever since, and though not now with the same company as myself he is not far away, and still in charge of running repairs, and to-day he came to me with the same old wink for the same old bar of soap to be used in the same old way. It took me back twenty-five years in one jump. He got the soap; it was worth more than one bar of brown, and they are only worth three cents now anyway.

How about his education? And remember he has been 40 years engaged in running repairs on locomotives, and three years foreman in the erecting shop.

Here is another case: We had a coal plant for handling coal from steamers, and the power for the clam buckets was furnished by small Lidgerwood hoisting engines, the business being under the supervision of the locomotive foreman at that point. These engines were away up in a tower and not on very steady foundation and they began giving trouble by running hot, and for two months the foreman kept an extra man with an oil can, pouring oil on the bearings to keep them cool. Finally, he left to accept a much better position and a younger man took his place. The first thing the younger man did was to take down the engines, true up the foundations and smooth the cut bearings. The trouble was at an end, and the man with the oil can lost his job.

Would it not have paid to educate these men to the point where they would undersand that the first principle of lubrication is mechanical correctness of the journals and bearings to be lubricated? I think it would, and while the two cases I have mentioned may seem exceptional, I find that there are still far too many men looking in the dope box and oil barrel for the trouble, when a little more knowledge of their own business would teach them that there is one chance in ten thousand that they will find it there.

The Salton Sea.

The Salton Sink is an area of many hundred square miles of desert land in the southeastern corner of California, which is 200 ft. or more below the level of the sea, and its gradual flooding, during the past year or two by the waters of the Colorado river, in consequence of carelessness in making an irrigation ditch has been the occasion of numerous newspaper articles which were not very illuminating. Finally, however, the *North American Review* has published an article by Edmund Mitchell, a Los Angeles editor, which describes the loss, the dangers and the probable distress in vivid language. From this article we take the following paragraphs:

Yuma, close to the State border-line between Arizona and California, is 140 ft. above sea-level. Past this town the Colorado River flows south toward the Gulf of California, a course of about seventy miles, with the gradual descent, therefore, of but two feet to the mile. But, from Yuma westward, the dip of the land is both deeper and more abrupt, so that at Salton, ninety-three miles distant, the depression is no less than 263 ft. below sea-level, the gradient being thus over four feet to the mile. From this lowest point, as we still move west, the country rises, and now at a sharper angle, for Indio, only twenty-five miles from Salton, is but twenty feet below sea-level, while Palm Springs, nineteen miles further on, has an elevation above sea-level of 584 ft. It is just beyond Palm Springs that the Southern Pacific Railroad emerges, through the grim San Gorgonio Pass, from the desert region into the fertile agricultural belt of Southern California.

This great saucerlike hollow is 137 miles across from Yuma to Palm Springs, with some sixty-five miles of the distance actually below the level of the sea. Imperial Valley, where for some years past a great irrigation project has been in progress, rises southward at a sharp pitch out of the Salton Sink, for Calexico, on the Mexican border, just forty miles south of Salton, is at sea-level. This is the limit of the United States lands, but the physical features of the country continue to be identical across the border-line, there being a steady uplift toward the Cocopah Mountains on the southern horizon. The Lower Colorado River has been flowing south along the rim of a deep hollow that lies to the west of its course. For a distance of about twelve miles below Yuma, a barrier of sand-hills prevents the current from taking the direction of the Salton Sink, its natural destination, as being the lowest point of depression. But, after passing this sand-hill ridge, the river, in the bed it occupied until recently, continued on its way through Mexico, a sluggish stream, depositing its heavy burden of silt scoured from a thousand miles of canons. To the right lay old and disused channels, into which some water spilled at flood time. But the river had dug its main bed from north to south through its own silt accumulations, and with only occasional changes, due to the caving-in of banks or the forming of new sand-bars, was content to keep to this course until the hand of man came to interfere with the delicately balanced condition of things.

Five years ago, the California Development Company set itself to supply irrigation water to the Imperial Valley. The Colorado River was the natural source of water-supply. But, owing to the sand-hill barrier above referred to, a canal was dug by a sweeping curve through Mexican territory, entering the Imperial country on its southern boundary. The necessary right of way through these Mexican lands was acquired from the owners, and the canal was dug, an old disused channel of the Colorado, known as the Alamo River, being largely taken advantage of in the engineering operations.

The intake was on United States soil. No head-gates were put into the canal; the river water was simply allowed to flow in, just as into an open ditch. The first few miles of the ungated canal has but a very slight fall, and, there being no settling basin provided above the intake, the channel became clogged up with silt. In the summer of 1904 the ditch was not carrying enough water to supply the wants of the Imperial Valley lands already under cultivation, and to prevent the danger of ruined crops the company decided upon taking a quick (and cheap) method of supplying its necessities. Four miles below the original intake, and therefore in Mexican territory, it scooped out a cross-ditch connecting the river directly at this second point with the canal. Once again no headgates were put in, and through this aperture, scoured deep and wide by a succession of floods, the entire waters of the Colorado River, instead of passing gently south to the Gulf of California, are now rushing down impetuously and uncontrollably into the Salton Sink. In other words, the Imperial Canal is now the Colorado River, restored to its ancient bed, the Alamo watercourse.

The winter of 1904-05 proved to be a season of abnormal rainfall and floods began the process of scouring out the narrow emergency ditch. The regular summer floods of 1905 continued the work, and, when the danger came to be realized, the breach was practically beyond repair. * * * The Southern Pacific Railway Company was virtually compelled to come to the financial assistance of the California Development Company, and all through the fall months of 1905 desperate and continuous efforts were put forth to turn back the Colorado into its old channel, but finally a mighty flood on November 30, the second highest ever recorded on the Colorado River, and once again caused by abnormal rains in Arizona, turned the whole plan into ridicule. The effect was not so much to break down the dam which had been made as to cut everything away around it; for there are no rocks to serve as foundations and abutments in this land of silt.

The water in the sink now covers 400 square miles. The Southern Pacific has had to move its track five times. A train now skirts the shores of the lake two hours in a trip from east to west. At Salton the water is 30 ft. deep. The channel where the river flows into Imperial Valley is now ten miles wide, and a waterfall, where the Colorado river washes its channel 30 ft. deeper, is receding up stream at the rate of a mile a day, endangering the whole country up to Yuma, and possibly endangering the Government irrigation dam, a mile long, now being built above Yuma. The lake level is still 230 ft. below the Pacific Ocean and so great is the evaporation by the torrid sun it is estimated that it will take 30 or 40 years to fill the sink to sea level. The only hope of staying this great work of nature, in defiance of the puny efforts of man, is the Laguna dam, above Yuma, where is a natural barrier, but this work is beset by some uncertainties. Mr. Mitchell gives an interesting account of the irrigation projects, and of the possible international complications due to the rise in the United States of water which by nature and by treaty ought to flow down the river into Mexico.

The New Canadian Pacific Steamers.

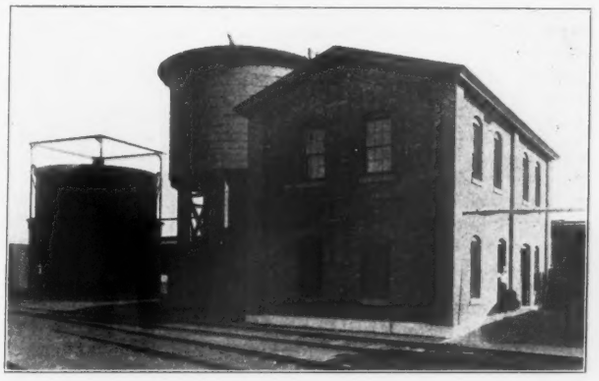
Supplementing the information given in the *Railroad Gazette* of Dec. 1, 1905, the following notes on the new Canadian Pacific twin screw steamers, "Empress of Britain" and "Empress of Ireland," are of interest. It will be remembered that these vessels are to be used on the Atlantic, bringing up the Canadian Pacific's Atlantic service to the standard of the trans-Atlantic lines to New York. By the Canadian Pacific route via Montreal and Vancouver the distance from England to Yokohama is 10,223 miles, and via Halifax and Montreal and Vancouver 10,488 miles, Halifax being the winter port for the new ships. By way of the Suez Canal the distance to Yokohama is 11,787 miles.

The new vessels have a gross tonnage of 14,155 tons and a

length over all of 570 ft. They are built on the double-bottom system and are divided transversely by ten bulkheads, so that at the normal draft of 27 ft. 6 in. any two adjoining compartments can be flooded without endangering the safety of the vessel. The weight of steel worked into the construction of each vessel was 7,200 tons, necessitating the use of over 1,000,000 rivets. In spite of this fact, the first ship was launched within eight months of the laying of its keel, construction having been begun on March 16, 1905, and the vessel being afloat on November 11 of the same year. Five months more sufficed for completion, the trial trip taking place on April 13, 1906. The vessel left on her first voyage on May 5, 1906, or within fourteen months of the laying of her keel. The vessels were built by the Fairfield Shipbuilding & Engineering Company, of Glasgow. Each vessel has eight decks, named as follows, beginning at the bottom: orlop, lower, main, upper, shelter, lower promenade, upper promenade and boat deck, the latter being 44 ft. above the load water line. The total area of the decks is four acres. The passenger accommodations are for 310 first-class, 468 second-class, 494 third-class and 270 fourth-class passengers. Officers, engineers, stewards and crew include 373 persons, making the total capacity of the vessel 1,915. As in the Canadian service, on the voyage from England a large number of passengers rather than cargo, and on the voyage from Canada, cargo rather than passengers are carried, portable cabins, which may be fitted up in a short time on the lower deck, thereby increasing the accommodations for emigrants are carried. When loaded to their mean service draft—27 ft. 6 in.—the vessels are required to carry a load of 6,500 tons, including stores. As a matter of fact, it has been found possible to carry 400 tons more. On the trial trips the "Empress of Britain" steamed 19.78 knots, with the engines indicating 18,750 h.p., and the "Empress of Ireland" 20 knots with the engines developing 19,200 h.p. These new boats have already succeeded in lowering the Atlantic record to Canada.

Acetylene Generating Plant for the Lackawanna.

The accompanying illustrations show the exterior and interior views of an acetylene generating plant equipped by the Commercial Acetylene Co., New York, for the Lackawanna Railroad at its Hoboken terminal. The equipment consists of two 200-lb. acetylene generators, four driers, one scrubber, one three-stage compressor, one 5,000 cu. ft. gas holder and five storage tanks of 2,000 cu. ft. capacity each from which the gas is delivered to the storage tanks on the cars. This plant, as it now stands, will take care of 750 cars a month, but with the addition of another compressor, arrangements for which were made when the plant was built, the capacity can be doubled. Part of the upper story of the generating house is used to store the drums containing the calcium carbide from which the acetylene is generated and part is devoted to the hoppers of the generators, over which is placed a small traveler for handling the drums of calcium carbide. The hoppers of the generators are filled with 200 lbs. of calcium carbide each. The carbide used comes in small pieces, measuring about one-half inch by two inches. These are mechanically dropped at suitable intervals into the water in the lower portion of the generator. As fast as the gas is generated it oozes through the water and flows through a pipe line to the gas holder placed at a convenient distance from the generating house. The gas returns to the generating building and passes through four small cylinders, filled loosely with coarse pieces of calcium carbide, called driers. The gas after passing through these driers reaches the purifier or scrubber absolutely dry, and in this state all traces of sulphur and phosphorus compounds are easily removed. From



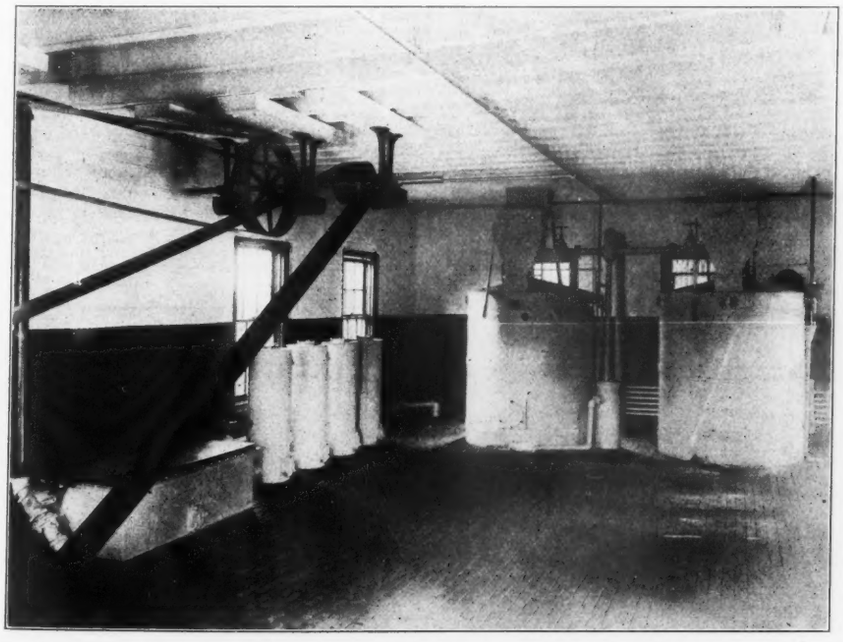
Exterior of Acetylene Generating Plant—Lackawanna Railroad.

the purifier the gas enters the compressor, which delivers it to the high pressure storage reservoir at about 150 lbs. pressure per sq. in. These storage cylinders or reservoirs are made of sheet steel, having a tensile strength of 65,000 lbs. per sq. in.

The tanks of the Safety Storage System are tested at a pressure of 1,200 lbs. per sq. in. One of these cylinders is shown in the accompanying illustration with a portion of its side cut away, showing the method of filling with asbestos. Before the head is finally

Safety Storage Gas Tank, Showing Asbestos Packing.

brazed in the cylinder is filled with perfectly fitting discs of asbestos, briquetted or held in shape with silicate of soda. These discs have a 20 per cent. solidity, or a porosity of 80 per cent., and are put into the cylinder under slight pressure. The head is then brazed on and suitable stud valves are fitted and it is connected to an air pump and a vacuum created. When a vacuum from 20 to 25 lbs. is reached the stud valves are closed, and the end of a pipe is attached to the stud valve with its other end immersed in a volume of acetone, equal to 43 per cent. of the cylinder's volume. The stud valve is then opened and the acetone drawn in by the vacuum previously created. The acetone is absorbed by the asbestos, and is evenly distributed throughout the entire mass. Acetone is a product of the destructive distillation of wood, and is similar to wood alcohol. It has the property of dissolving many times its own volume of acetylene, and of giving it off when the pressure is released. The cylinder is next charged with acetylene to about two atmospheres, or 30 lbs. The stud valve is then closed and the cylinder allowed to stand until the acetone is completely saturated with the gas. When this saturation is complete the stud valve is opened and the gas allowed to blow off, only retaining the amount of acetylene that the acetone will dissolve at atmospheric pressure. The cylinders, after being treated in this manner, are ready to be charged for service. To facilitate rapid charging, the storage reservoirs at the compressing plant have two inlets for the gas, one at each end, so that the acetone is dissolving gas from supply points at the same time, and the set of five cylinders forming the reservoir are connected to each other by one main pipe line and a branch pipe line to each end of each cylinder, so that there are ten openings to discharge the gas into the acetone. This also applies to the discharge from the reservoir to the pipe line, where the cylinder or cylinders are to be charged, and insures such a low rate of discharge from each opening that the



Interior of Acetylene Generating and Compressing Plant—Lackawanna Railroad.

gas passes away without carrying any appreciable quantity of acetone with it. As the acetone is the dissolvent of the gas, very little will pass away, and in case it does, it is taken up by the asbestos in the cylinder or cylinders being charged, thus keeping the cylinders in service up to the standard, and leaving only the storage reservoir to be replenished. Acetone has a greater capacity for dissolving acetylene at a low temperature. For that reason, acetone which is charged at a pressure of 150 lbs. at a low temperature will give off gas when the temperature rises, and the pressure in the cylinder will increase. Conversely, when the temperature falls the pressure will also fall, as the acetone will redissolve the acetylene. Acetylene thus stored in a porous substance, like asbestos, and held in solution by acetone, cannot explode while in the cylinder.

The Delaware, Lackawanna & Western plant has been in operation since October, 1904. Special lamps for burning acetylene are recommended, but Pintsch lamps from which the superheaters have been removed and in which special acetylene burners have been fitted in the globes give good results. These are known as converted Pintsch lamps. The car tanks furnished with this system measure 114 in. long x 20 in. in diameter, and have a storage capacity of 2,000 cu. ft. of acetylene gas which represents 100,000 c.p. hrs. of available light for each car.

Steel Passenger Car for the Pennsylvania.

The Pennsylvania Railroad has designed and built at Altoona an experimental steel passenger car which is now in service on the main line between Philadelphia and Lancaster, Pa. The underframe consists of a central box girder 24 in. wide and 19 in. deep, extending from end to end of the car, including the platforms and four cantilevers on each side between the bolsters supporting the deep plate girder sides. The vestibules and end construction of the body have been designed to resist telescoping. The end door posts are riveted at the bottom to the central girder and at the top to a heavy horizontal reinforcing plate. In the vestibule the ceiling consists of a wide horizontal steel plate reinforced in such a manner that it forms a strongly braced girder under the roof framing. Steel posts of heavy section and spaced 6 ft. apart support the main steel roof carlines, the side plates being heavy angles. The floor consists of corrugated plates riveted to the underframe and covered with a layer of plastic fireproof material resembling stone when hardened.

The inside lining consists of steel plates, except directly under the roof, where a composite board will be retained. The outside sheathing of the roof is also steel, so that the whole outside of the car presents one unbroken expanse of steel plate with openings for the windows. The doors are composed of steel plates pressed into a shape imitating wooden doors used in other cars, and filled with cork to deaden the sound. The seats have steel frames covered with fireproof plush. The footrests are of steel; in fact, no wood or inflammable material has been used, except the top of the seat arm, which was made of wood for comfort of passengers, steel being considered cold to the touch. Experiments will be made with seat arms made of metal to determine the amount of discomfort and also whether it would be advisable to substitute metal.

The car is equipped for electric lighting only. The wires have been carefully insulated, and are carried in metal conduits. The storage batteries are in steel boxes, which are hung from the underframe of the car.

The brake arrangement is of the latest and most improved type, and special care has been given to the design of the draft gear to provide exceptional strength and a maximum amount of flexibility to avoid strains due to curving of car. The P. R. R. standard ventilating system and four-pipe heating system are used.

The trucks are of special design, made necessary by the depth of the central box girder. They have 36-in. wheels and are entirely of steel. The principal dimensions of the car are as follows:

Length over buffers	67 ft. 5¾ in.
Length inside	57 ft. 10½ in.
Width at eaves	10 ft. 1 in.
Height to top of car	14 ft. ½ in.
Height to floor	4 ft. 4 in.
Truck centers	45 ft. 3 in.
Window centers	2 ft. 11½ in.

Interior of Steel Passenger Car, Pennsylvania Railroad.

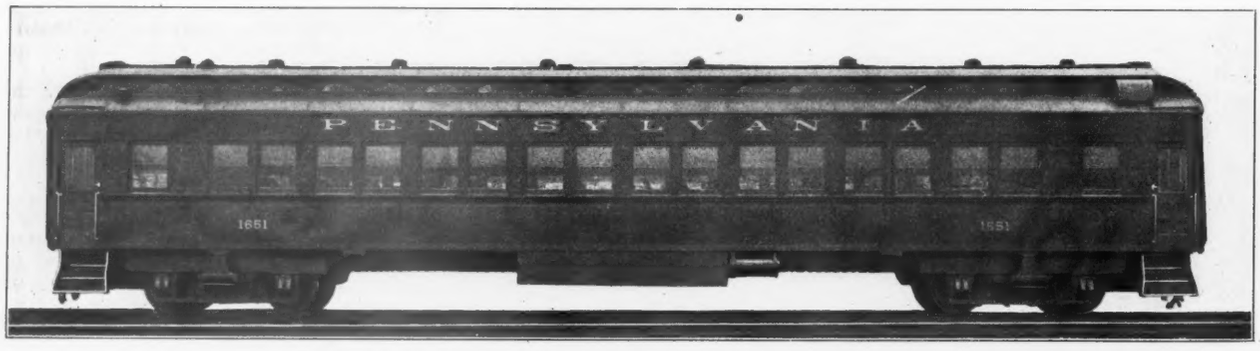
Mistakes in Waterproofing.*

The majority of engineers and architects still follow old-school methods, believe that concrete is waterproof—especially if it be reinforced—and give no special attention to the importance of design. A faulty design will invalidate the best methods and materials. This is particularly so in bridge work. If the bridge be not properly designed to receive waterproofing, it is almost impossible to make the deck or floor watertight.

It is a mistake to use a set design or specification for general work. Each condition has its characteristics, and should be carefully considered, especially with reference to the nature of the climate, water, soil, rock, water-pressure, use of the structure, etc.

A prominent New York architect made the mistake of using on the exterior surfaces of the walls of a 22-story office building a waterproofing material simply because it had been used fairly suc-

*From a paper read before the American Society for Testing Materials by Edward W. De Knight, Manager of the Hydrex Felt & Engineering Co., New York.



Steel Passenger Car, Pennsylvania Railroad.

cessfully on the bottom of a reservoir. His mistake was in the end costly.

In another mistake the floors in a cold storage building, with a constant temperature near zero, were designed to be waterproofed with materials similar to those used in an ordinary warehouse where the temperature ranged from near zero to 90 deg. F. There had been no thought of making the method and consistency of the products suit the conditions, and the materials used in the cold storage floors turned, in time, almost to powder. In another mistake, an engineer used a reservoir design and method for the foundations of a 12-story office building near tide water. The design being radically inappropriate, the sub-basement floor and its waterproofing were broken through when the building was up seven floors. Within 24 hours the water was 15 ft. high in the basement. It cost $10,000 to remedy this mistake.

In another mistake the design was faulty in improperly grading the surface carrying the waterproofing, which, by missing the outlets by a fraction, allowed sufficient backwater to find its way inside, instead of outside a magnificent granite structure. This mistake will likely cost nearly $40,000. A waterproofing engineer who would have, at a glance, noticed the error in the drawings, would certainly in that case have been worthy of his fee.

In another mistake, a wrong design for concrete arch viaduct waterproofing caused the reservoirs to be filled with water which could not escape through deep pipes stopped by cementation. The freezing of the water burst the concrete. After four years it was necessary, to save the viaduct, to properly waterproof it. This mistake was exceedingly costly.

In mill protected property—factories, warehouses, etc.—the losses from water are far greater than the losses directly from the fire. The mistakes in designing floor waterproofing have, in this respect, cost hundreds of thousands of dollars. Yet it is practically a simple thing to design a floor so that it will perfectly retain water to the depth of several inches, and make it independent of and also a protection to every other floor.

The writer firmly believes that no material should be used for waterproofing which is not elastic. He also as firmly believes that no material should be used for waterproofing which becomes hard or vitreous. These two facts seem so self-evident that they will in time, no doubt, be taken as accepted principles. It is a serious mistake, therefore, to attempt to waterproof concrete by hardening the surface, or by using thereon a cement-plaster. We know that this method of attempting to waterproof possesses attractive features which appeal to many engineers and architects; but notwithstanding this fact, our personal opinion is that these features are misleading. The writer is a representative of the school of elastic waterproofing as opposed to the school of hard, vitreous or rigid waterproofing.

The fact that the method may have in certain cases served well for several years misleads one into using it for permanent work. By the very nature of a hard surface that surface must serve for a time, but also by that very hardness will the waterproof value of the surface be destroyed. The value of waterproofing lies not in what it is to-day, but in what it is many years hence.

We are told that the hardening process or the cement-plaster method must be applied to the inside surface of the wall, where it can be easily reached and the cracks patched. Patching is not perfection. Waterproofing must not crack; if elastic, it will not crack. Anyone recommending the application of waterproofing on the interior surface of a foundation wall certainly knows little of the right theory of waterproofing. It is against common sense and the logic of things to place the waterproofing in front (where in time it can be shoved off) of the line of resistance (the wall) instead of behind it. One of the chief uses of waterproofing is to keep water entirely from the wall—instead of allowing it to come to and through it—and by capillarity work up and saturate the entire wall—and in the course of years press off the hardened cement, or even paint, coating on the other side which it must finally do by the very law of nature.

Another thing—water should not be fought. It must be led. Waterproofing is part of the general scheme of drainage. Its purpose is to check water, to lead it, and direct its flow naturally to some point where it can be disposed of through properly arranged drains. Water will always find the weakest spot in the strongest cement, though it may travel a long way and take a long time to do it. The cement-plaster theory seems to have no bearing whatever on drainage. It means the fighting of water—and from the wrong side of the wall. The hardness of the plaster may keep back water for several years, but it must in time come through and the cement come off.

Even though the coating or the cement be placed on the outside of the wall, where it then cannot be readily reached to patch cracks, it will, in the majority of cases, eventually crack because, being set, hard and rigid, it cannot accommodate itself to contraction and expansion, etc. It could not possibly be used on a bridge floor. The vibration would destroy it. Nor can it be used on a roof.

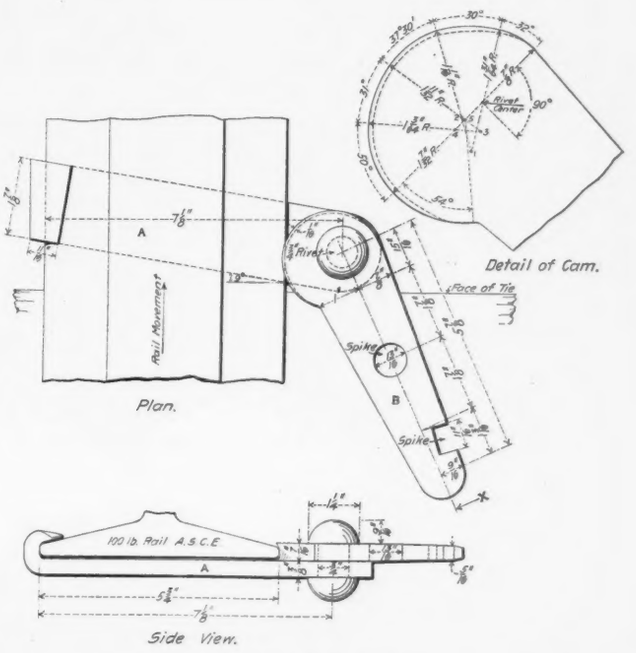
An elastic waterproofing is not confined to one suitable material, but may be composed of many. It may be described as follows: It should resemble a membrane or skin—be, in itself, i.e., in one sheet, absolutely impervious to water; be flexible, tough and elastic; be made of materials specially made to withstand the injurious action of water and all underground conditions. As many sheets or layers of this impervious membrane or skin should be cemented or veneered together as the conditions require. This stratum of waterproofing when in place must be independent of—a thing apart from—the surface or thing waterproofed, which may vibrate or settle, twist or crack, expand and contract, without in the least affecting it, exactly as is the hide of a horse or the skin of one's hand free and independent of the surrounding tissue so that it may readily and naturally yield to every move of the body or the hand. This principle of elasticity, coupled with independence of movement, in waterproofing was termed by the writer some time ago as the "improved membrane method," to distinguish it from the old-school process of sticking the waterproofing fast to everything to be waterproofed.

It is a question of method, and, as can be readily observed, is diametrically the opposite of the principle of rigidity in waterproofing—no matter what may be the materials.

A common and serious mistake is in attempting to do waterproofing with incompetent, inexperienced men. The average contractor will try to do the work with his own men, usually ordinary laborers, or will sublet it to a roofer. Roofing is not waterproofing. The average roofer thinks he knows how to waterproof, but unless he has many times had the actual experience he knows really little of good waterproofing. It takes more time and patience than roofing—the method of applying the materials is quite different—and if rightly done should receive much higher pay than roofing, which is ordinarily a very simple and easy operation. Waterproofing, however, especially water-pressure work, requires not alone skilled labor, but frequently considerable engineering skill.

The Prentice Rail Anchor.

George H. Prentice, roadmaster of the Lake Shore & Michigan Southern, at Painesville, Ohio, has designed and patented an "anti-creeper"—to prevent the rails of a track from sliding down hill, or in the direction of traffic—which is made fast to the rail by a cam and a lever without boring or punching the rail. The design of this



The Prentice Rail Anchor.

anchor and the dimensions of one made for 100-lb. rails of the A. S. C. E. section are shown in the accompanying drawing. The anchor is to be fastened to the tie on the inside of the rail. It is made of soft steel and the two parts are held together by a rivet ¾ in. in diameter. In applying, the arm B is driven in the direction of the arrow x until the rail is held securely, and when thus driven it should lie at an angle of about 25 deg. with the rail, as shown in the drawing. With a rail that has a base wider or narrower than that shown in the drawing, the distance between the bearing at the left and the center of the rivet (7⅛ in.) should be made greater or

less accordingly. The piece marked A has to be made in two forms, one for the left-hand rail and one for the right-hand.

Being placed on the inside of the rail, the anchor aids in holding the track to gage.

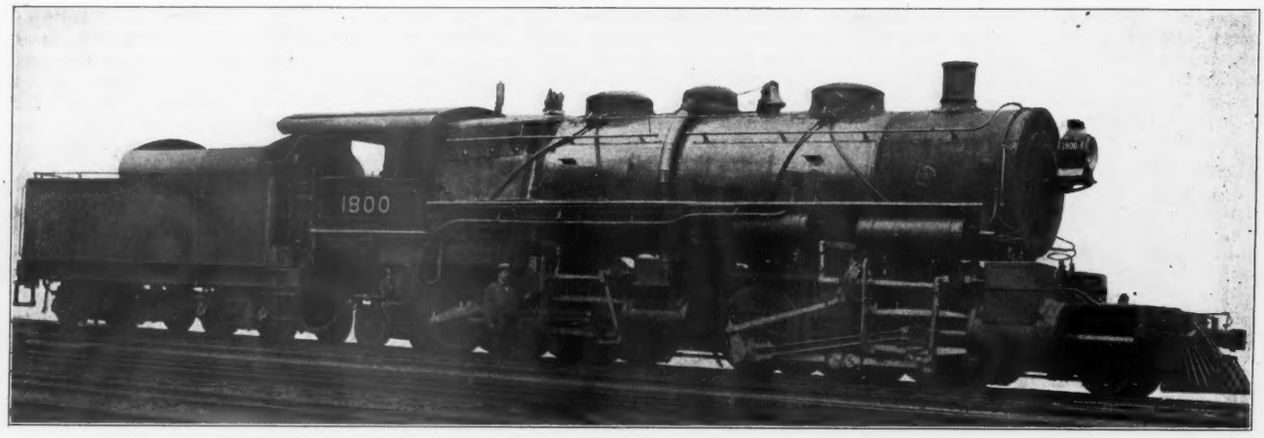
Mr. Prentice has used several hundred of the rail anchors on his division, and they are to be put in use on the other divisions of the main line of the Lake Shore. They are also to be tried on the steep grades of the Boston & Albany between Pittsfield and Springfield. Mr. Prentice estimates that, in practice, where automatic signals are in use, and where, consequently, switches must be kept accurately adjusted in order to prevent disturbance of the electrical connections in the switch boxes, the use of anchors to keep the rails from sliding will save the labor of one man on a section, which may be estimated as equal to $60 per year per mile of track.

Mallet Compound Locomotive for the Great Northern.

The accompanying illustration shows one of five Mallet compound locomotives, recently built by the Baldwin Locomotive Works for the Great Northern. These engines are the heaviest thus far built by this company, and exceed in total weight the Mallet compound on the B. & O., which weighs 334,500 lbs., all of which is on the drivers. They are intended for freight service, and are designed to pass 10-degree curves. The tractive power working compound is 71,600 lbs.

These locomotives are provided with two-wheel front and rear trucks, which are equalized with the front and rear groups of driving-wheels respectively. The front truck has a center bearing, while the rear truck has side bearings. This arrangement should reduce flange wear on the driving-wheels and enable the engines to curve readily and ride smoothly.

Weight on trailing truck	20,000 lbs.
Weight, total	355,000 lbs.
Weight, engine and tender	503,000 lbs.
General Dimensions.	
Wheel base, driving, each group	10 ft.
Wheel base, total engine	44 ft. 10 in.
Wheel base, total engine and tender	73 ft. 2¼ in.
Heating surface, firebox	225 sq. ft.
Heating surface, tubes	5,433 sq. ft.
Heating surface, total	5,658 sq. ft.
Grate area	78 sq. ft.
Wheels and Journals.	
Drivers, number	12
Drivers, diameter	55 in.
Truck wheels, diameter	30 in.
Journals, driving axles	10 in. x 12 in.
Journals, truck axles	6 in. x 12 in.
Cylinders.	
Cylinders, diameter	21½ in. & 33 in.
Piston, stroke	32 in.
Valves, type	Balanced slide.
Boiler.	
Type	Belpaire
Working steam pressure	200 lbs.
Diameter	84 in.
Thickness of sheets	⅞ in.
Staying	Vertical crown stays
Crown sheet, thickness	⅜ in.
Tube sheet, thickness	½ in.
Firebox.	
Length	117 in.
Width	96 in.
Depth, front	79½ in.
Depth, back	76½ in.
Thickness of sheets	⅜ in.
Water space—Front, 6 in.; sides, 5 in.; back	5 in.



Mallet Articulated Compound Locomotive. Built by the Baldwin Locomotive Works for the Great Northern.

The boiler is of the Belpaire type, with straight throat sheet and sloping back head. The waist is built up of three rings and is 84 in. in diameter at the front end. The circumferential seam in front of the dome is triple riveted, the others being double riveted. The horizontal seams have diamond welt strips. The water spaces are unusually wide, while the tubes are spaced with ¾-in. bridges.

The dome is of cast steel. It is provided with a "Rushton" throttle, having an outlet on each side. Steam is conveyed to the external pipes through short connecting pipes, which are cast in one piece with the dome.

All four cylinders are provided with balanced slide valves driven by Walschaert valve gear, the McCarroll air reversing mechanism being used. The high pressure cylinders which drive the rear group of wheels are cast separately from their saddle, which is bolted to the upper frame rails. The low pressure cylinder castings meet on the center line of the engine and are bolted together. The steam pipe connection between the high and low pressure cylinders has a ball joint at the rear end and a slip joint with a packed gland at the front end. The exhaust connection between the low pressure cylinder and smoke box has a ball joint at each end and a slip joint in the middle.

The frames are of cast steel and are 5 in. wide throughout. The rear frames have double front rails cast in one piece with the main sections. The front frames have separate top rails, which pass over the low pressure cylinder castings. The frames are strongly braced transversely by heavy castings, which serve at the same time as boiler supports. The saddle under the smokebox is provided with coiled springs, which help to bring the front group of wheels in line after rounding a curve.

The principal dimensions of the engine are as follows:

Kind of fuel	Soft coal
Weight on drivers	316,000 lbs.
Weight on front truck	19,000 lbs.
Tubes.	
Number	441
Material	Steel, No. 11 gage
Length	21 ft.
Diameter	2¼ in.
Tender.	
Water capacity	8,000 gals.
Coal capacity	13 tons
Wheels, diameter	36 in.
Journals	5½ in. x 10 in.

Chicago Grain Elevators.

Some eastern railroads own elevators and operate them as transfer plants only, for the benefit of the shippers. Some western roads own elevators and lease them. Others do not own any. In no case is a railroad in the elevator business commercially. Grain is free to go from any western road to any elevator without tax, the reconsigning charge of $2 per car having been abolished by all lines last year. Nowhere else has grain freer movement than in Chicago.

The large elevator interests own and lease their elevators. Nor is there any combination among elevator interests to regulate prices of grain. Elevator competition is the sharpest known in the grain trade.

Chicago's elevator capacity is between 65,000,000 and 70,000,000 bushels, or about 5,000,000 less than a few years ago—loss due to fires. There is so much competition it does not pay to run the existing elevators. There is more elevator capacity than business. As conducted to-day, the elevator business will not, with a few exceptions, permit of private ownership and allow a profit. Originally the railroads owned all the elevators. In some states they must provide them at stations as well as at terminals.

One disadvantage local elevator interests labor under is the limited term of six months during which they have the transit privilege in freight rates. Grain stored longer has to take the turn of local rates, if it moves east all-rail.

Some abuses have crept into the elevator business, but they have been such as carried their own correction with them, as a rule.—*Wall Street Journal.*

GENERAL NEWS SECTION

NOTES.

The El Paso & Southwestern System has adopted the Brown system of discipline.

Lumber rates from Nashville, Tenn., to Pittsburg and Buffalo common points have been advanced 3 cents a hundred pounds.

Ballasting crews on the Lincoln (Neb.) division of the Chicago & North-Western have been withdrawn, owing to the heavy volume of regular traffic.

The passenger department of the Santa Fe has undertaken to help in the rebuilding of San Francisco by advertising throughout its lines the need of labor.

The Erie has sent solid silver annual passes in the form of watch charms, with the name of the holder engraved on each, to the presidents of other railroads.

The Great Northern and Northern Pacific have made considerable reductions in all classes of rates to Butte, Helena and Anaconda common points in Montana.

A test case is to be brought before the Texas Railroad Commission in regard to export lumber traffic, on which the commission desires to raise the freight rates.

A bill has been introduced in the Georgia senate prohibiting the building of any railroad within fifty miles parallel to the Western & Atlantic, which is owned by the state.

The Big Four on August 14th gave notice of a reduction of two cents a hundred on the three classes of export grain from interior points in Illinois to tidewater at Newport News.

An invention is now reported by which a moving locomotive automatically turns on electric lights along the track a mile in advance, thus doing away with the necessity of headlights.

The Southern Pacific, partly as the result of labor difficulties, has reduced the force at its Sacramento shops and plans to have most of the work done at some of its eastern shops in future.

Owing to the Grand Army encampment at Minneapolis this week there has been the heaviest passenger travel ever known in the Northwest. The total attendance is likely to exceed 100,000.

There are being turned out from the West Milwaukee shops of the St. Paul new freight cars which are stenciled "Chicago, Milwaukee & St. Paul Railway Company—Pacific Coast Extension."

The express business of the Texas Central, which is now carried on by the Pacific Express, is soon to be turned over to the Wells Fargo, adding 275 miles to the mileage of the latter company.

An investigation of railroads in the territory of Oklahoma has been begun by the Attorney General, at the suggestsion of the Governor. Its object is to discover discriminations in freight rates.

In order to improve the connections between the Louisville & Atlantic and the Queen & Crescent Route, an independent motor car company has put in service an automobile line which makes four trips a day.

The Canadian Pacific now runs a quick lunch car—a regular 72-ft. diner equipped with a lunch counter affording accommodations for more than 50 people. The car has a refrigerated cellar about 3 feet deep.

The new freight terminals of the Missouri Pacific System in St. Louis, bounded by Biddle, O'Fallon, Collins and Second streets, have been opened for business, making the third freight station of the road in that city.

The Wisconsin Railroad Commission on August 9 handed down a decision by which grain rates in the state will be reduced on the average about one cent a bushel. The order is the most sweeping yet issued by the commission.

William Anderson, track foreman of the Chicago, Burlington & Quincy at Louisville, Neb., has received from the company the gift of a gold watch, in recognition of his vigilance in watching the road during a time of heavy rains.

In order to provide a suitable thoroughfare for teams, the Central Railroad of New Jersey plans to repair and repave, at a cost of $100,000, one of the streets in Jersey City leading to its yards at the Communipaw terminal.

News comes from Omaha that all the railroads in that region, including all the Harriman Lines, have ordered all outstanding passes, both trip and annual, canceled after August 28, the day the new rate law goes into operation.

An order has been issued from the headquarters of the Pennsylvania calling the attention of division officials to the increase in the volume of freight traffic over last year, in order that all precautions may be taken to prevent congestion.

The Peavey Elevator Company, of Minneapolis, through the British American Elevator Company, Ltd., with head offices in Winnipeg, has given the contract for the first of 20 grain elevators which it is to build on the lines of the Canadian Northern.

Traffic officers are quoted to the effect that a car congestion more serious than last year's is imminent in the Northwest. In this connection the Canadian Pacific announces that it has 621 locomotives and over 20,000 cars in its western territory.

The Chicago Subway on August 14 began to move freight between the Santa Fe, Erie, St. Paul, Chicago & Alton, and Wabash freight stations, the wholesale warehouse of Marshall Field & Company and the plant of the Monarch Refrigerating Company.

Reductions are to be made in the Armour Car Line rates for transportation of fruits and vegetables from Oregon and Washington points to the East, averaging a reduction of $10 a car to Missouri river points. To New York the new rate is to be $42.50 instead of $65.

It is reported in Harrisburg, Pa., that the Pennsylvania Railroad, on completion of its new road from the Susquehanna river to Atglen, will be able to move through freight with a smaller number of engines, and that, therefore, about 200 brakemen and firemen will be "let out."

The Sheffield Elevator Company, at Minneapolis, is to increase by 500,000 bushels the capacity of its elevator K, and it is stated that with this increase, and three other similar ones now being made, the elevator storage capacity for grain in that city will aggregate 37,000,000 bushels.

A despatch from San Antonio, Tex., says that on August 11th a cloudburst at Langtry swept away six miles of Southern Pacific main line track and eight bridges in that region. Later despatches indicate that 20 miles of track has been swept away. Through traffic has been transferred to the Texas & Pacific.

The New York Central has compromised with its striking tugboat men by granting an increase in wages of $5 a month for both classes of deck hands. This satisfies the demands of all but the first-class deck hands, who asked for a $10-increase. Most of the other roads have not yet come to a final settlement with their men.

The Wisconsin Railroad Commission has given an opinion that the St. Paul road is not a common carrier of private cars, and that its past custom of carrying such cars does not have the force of law in compelling it to do so in the future. The opinion was given in answer to a complaint against the railroad company for refusing to carry private theatrical cars.

The steel freighter "Troy" of the Western Transit Company (N. Y. C. & H. R. R.) on August 11th collided with a draw span of the interstate bridge at Duluth, knocking it from the pier on which it revolved and blocking the channel on both sides, thus temporarily closing navigation to the upper harbor. The bridge is owned by the Great Northern. The draw span is 500 feet long, one of the longest in the world.

According to a St. Louis despatch, the Wabash, the Big Four and the Clover Leaf, on the first of their low-rate summer excursions on August 9, from St. Louis to Niagara Falls, carried 4,300 passengers in 13 special trains. The Wabash carried 2,600, the Big Four 1,200, and the Clover Leaf 500 of the excursionists. The rate was $10 for the round trip of about 1,500 miles. There are to be four other similar excursions.

The Texas & Pacific, answering the inquiry of the Interstate Commerce Commission in regard to the relations of railroads and grain elevators, says that, with one possible exception in which the facts are submitted to the commission's judgment, no special facilities have been given within the last three years to elevators, and that no official director or employe of the road, so far as can be ascertained, has been interested in the ownership of elevators.

A conference of some sixty representatives of the legal departments of the larger railroads east of the Mississippi, particularly those in Southern and New England territory, was begun in Atlantic City on August 14 to study the provisions of the new rail-

road rate bill. Judge Edward Baxter, of Nashville, Tenn., the presiding officer, made a statement to the effect that the meeting was for the purpose not of trying to evade but of understanding the new law.

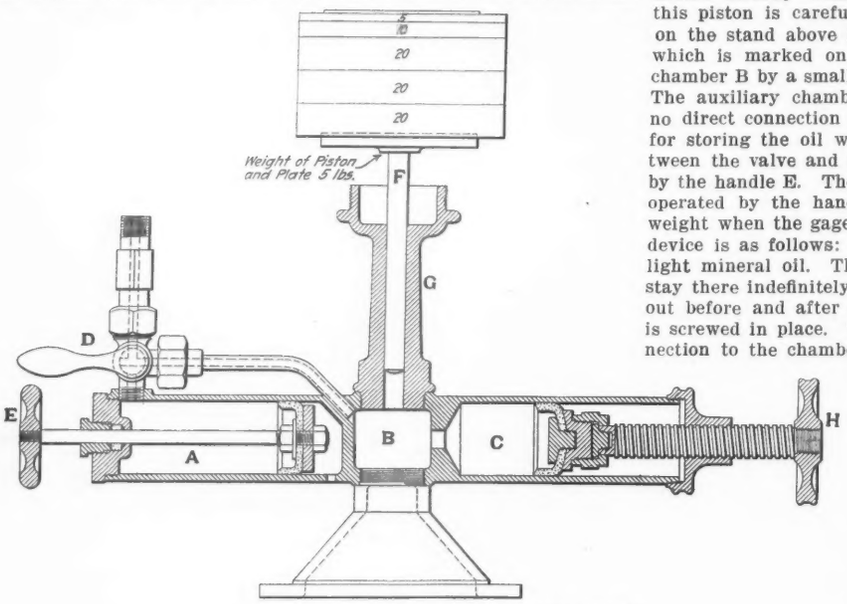
The Interstate Commerce Commission on August 15 issued an order to every railroad in the country to report not later than Sept. 1, 1906, the total number of freight cars owned on Aug. 1, 1906, together with the number of such cars equipped with air-brakes. This order is given by the commission to see whether or not the railroads are complying with the order of the commission dated Nov. 15, 1905, which made it compulsory for 75 per cent. of the cars in a train to be equipped with air-brakes.

We take the liberty of publishing the following item from the *Nashville American*:

Doubles Its Motive Power.

"Livingston, Tenn.—(Special).—H. E. Speyer, General Manager of the Overton County Railroad, in company with the engineer, Charles Corlton, left here yesterday for Cincinnati, where they will purchase a new engine for the road. Up to this time only one engine has been used, but it is unable to handle the business."

An agreement as to rate of pay is reported to have been made between the Pennsylvania and the men who will work on the electrified line of the West Jersey & Seashore between Camden and Atlantic City, to be opened next month. Conductors are to receive $3.85 and brakemen $2.04 for a 10-hour day. Motormen are to be paid two cents a mile to Atlantic City on a basis of 210 miles a day, 2¼ cents to Millville on the basis of 200 miles a day and 2¾ cents a mile between Camden and Woodbury.



The American Dead-Weight Gage Tester.

An investigation of some 15 railroads was begun on August 14 by the Interstate Commerce Commission in Toledo, through Judson C. Clements, a member of the Commission, regarding the interstate transportation of ice to and from that city. The first day's proceedings developed the fact that a former purchasing agent of the Ann Arbor Railroad, now under sentence of imprisonment for acts done as manager of the Toledo Ice & Coal Company, while in the service of the road had sold ice for the ice company. He also testified that both the former president and general manager of the Ann Arbor were directors of the ice company and that practically all the stock in the company was owned by railroad men. It was also charged that railroad real estate was used by the ice company without compensation and that laborers were transported for its account by the road without paying fare.

Some 400 Chinese laborers have recently arrived in Mexico from China to work on the Kansas City, Mexico & Orient in the northern part of the Republic.

On the Manzanillo extension of the Mexican Central 1,500 Japanese laborers are to be used, of whom 500 will arrive shortly and 1,000 some time in November.

The experiment of using Chinese labor on the Panama Canal is to be tried with 2,500 Chinamen at the start. If their work is satisfactory, it is probable that much larger numbers will be taken to the Isthmus.

At Jamestown, N. Y., August 10, the Federal grand jury reported indictments against the Standard Oil Company, of New York, the Vacuum Oil Company, and the Pennsylvania Railroad. The indictments are based on a charge of carrying oil from Olean, N. Y., to Rutland, Vt., in January, 1904, at less than published tariff rates.

At Chicago, August 8, the Federal grand jury returned an indictment, containing 19 counts, against the Standard Oil Company for accepting rebates from the Lake Shore & Michigan Southern. The rebates consisted of free storage of oil under circumstances where other oil shippers had to pay storage.

It is understood that following the grand jury investigations of the relations between the Standard Oil Company and the railroads, the Lake Shore has given notice to independent oil dealers that hereafter mileage fees on their oil tank cars will be computed on the same basis as on the cars of the Union Tank Line, belonging to the Standard Oil Company.

The American Dead-Weight Gage Tester.

The accompanying illustration shows the American dead weight gage tester made by the American Steam Gage & Valve Mfg. Co., Boston, Mass. This device possesses all the advantages of the mercury column. It is compact in form and is absolutely reliable at all times, thus doing away with the necessity of returning test gages to the factory from time to time for readjustment so as to be assured of their accuracy. Referring to the illustration it will be seen that the device consists of a main pump cylinder B, connected directly with the cylinder G and piston F. The area of this piston is carefully figured, and when the weights are placed on the stand above it they give the exact pressure per sq. in., which is marked on them. The gage is connected to the piston chamber B by a small pipe in which is placed the three-way cock D. The auxiliary chamber A, which is used as an oil chamber, has no direct connection with B, but is simply used a an oil reservoir for storing the oil which is required for filling the connection between the valve and the gage. It has a plunger which is operated by the handle E. The cylinder C is provided with a screw plunger, operated by the handle H, for raising the piston F while under weight when the gage is in place for testing. The operation of the device is as follows: The chambers A, B and C are filled with a light mineral oil. The oil, when once put into the cylinders, can stay there indefinitely, and thus the necessity of pouring it in and out before and after testing is eliminated. The gage to be tested is screwed in place. The three-way cock D is then set to give connection to the chamber A. The plunger E is pulled out until the gage shows pressure, thus indicating that the connections are filled with oil. The three-way cock is then turned so as to close the connection to chamber A and to open the connection to chamber B. The weights corresponding to the pressure desired, less 5 lbs., the weight of the stand and piston, are then placed on the stand and the screw plunger C is forced inward, by turning the handle H, until the pressure acting on the piston F raises the weights, at which time the gage, if properly adjusted, will show the pressure indicated by the weights on the stand. After testing and before disconnecting the gage the handle E is pushed inward and the three-way cock turned to allow the oil from the gage connection to be collected in the oil reservoir A, thus preventing the loss of any oil during testing. All tests are made with dead weights in 5-lb. units. This device can be furnished for testing to any desired pressure up to 1,000 lbs.

New Transcontinental Automobile Record.

The trip from San Francisco to New York, over 3,500 miles, seems likely to be covered in 15 days by a 30-h.p. six-cylinder automobile, which reached Conneaut, Ohio, on August 15, and was delayed one day there on account of an accident. The old record, made two years ago, was 33 days. The western end of the trip was made by roads following the Central Pacific-Union Pacific route. The time between Sacramento and the summit of the Sierra Nevada mountains, which involved a climb of 7,000 feet, nearly equaled that of the Overland Limited. Omaha was reached in nine days and Chicago in 11 days.

The Fare to Coney Island.

On Saturday, August 11, Justice Gaynor of the Appellate Division of the Supreme Court of New York, in Kings County, handed down an obiter to the effect that the arrest of a passenger for refusing to pay a second fare while returning from Coney Island to New York over one of the lines of the Brooklyn Rapid Transit Company was not justified as the prevailing 10-cent fare to Coney Island was illegal. On the following day, Sunday, many persons, basing their action on this decision, refused to pay a second fare to Coney Island. The company had employed special policemen who ejected from the cars about 1,000 such protesting passengers. The service was greatly delayed, and one death was caused indirectly as a

result of the disturbance. On Monday there was again almost a riot which resulted in the abandonment at 6 p. m. of all service to Coney Island by the Brooklyn Rapid Transit. Service was later resumed on the winter schedule with half-hour headway. Throughout Tuesday and Wednesday passengers who refused to pay the second fare were ejected from the cars.

TRADE CATALOGUES.

Curtains and Fixtures, Sash Locks and Nut Locks.—The National Lock Washer Co., Newark, N. J., is distributing the first edition of its catalogue. The book is handsomely done and contains detailed illustrations and descriptions of the various devices made by the company. These include car curtains, curtain fixtures, sash locks, sash balances and a number of designs of nut locks. Inserted at the back of the catalogue are a number of perforated specification blanks for curtains and sash balances, intended for use when asking quotations or ordering.

Railroad Water Service Supplies.—Catalogue C of the American Valve & Meter Co., Cincinnati, Ohio, is entitled "Railroad Water Service Department." The several styles of Poage water columns are illustrated and described in detail, prominence being given to style D with the Fenner drop spout. Detail parts are shown to illustrate their construction and lists of parts of the different styles given; also directions for setting up. Tank pipe valves, indicators, strainers, relief and float valves and other tank fixtures are also included.

Electric Blue Print Machine.—The Franklin automatic continuous-feed electric blue printing machine is described and illustrated in a pamphlet issued by Williams, Brown & Earle, Philadelphia, Pa. This machine is arranged so as to operate continuously and will print, wash, potash and dry blue prints and deliver them on a table top ready for use all in seven minutes from the time that tracings and sensitized paper are put into the machine.

Electric Traction Supplies.—Four recent bulletins sent out by the General Electric Co., Schenectady, N. Y., are the following: No. 4,443, dealing with the Sprague-General Electric Multiple Unit Control for A.C. and D.C. operation; No. 4,447, low voltage three-phase generator and feeder panels; No. 4,449, potential and synchronizing plug switches, and No. 4,450, list including prices of the parts of the type GE-80-A railway motor.

Large Steam and Electric Locomotives.—The American Locomotive Co. is distributing an illustrated reprint of a paper on large steam and electric locomotives read before the New York Railroad Club at its February, 1906, meeting by J. E. Muhlfeld, General Superintendent of Motive Power of the Baltimore & Ohio. An abstract of this paper was published in the *Railroad Gazette* of Feb. 23, 1906.

Electric Batteries.—An illustrated pamphlet issued by the Edison Manufacturing Co., Orange, N. J., describes a dozen primary batteries for small fan motors, gas engines and railroad signals. The batteries are of the caustic potash type and copper dioxide, compressed into briquettes; is used for the negative plate and also acts for a depolarizer.

Coal Mining.—A handsomely illustrated catalogue of coal mining machinery has been issued by the Sullivan Machinery Co., Chicago, Ill., makers of air compressors, coal cutting machines, rock drills, engines and similar mining equipment. A large part of the catalogue is taken up with a clear and comprehensive argument in favor of machine mining as compared with coal mining by hand.

Lead Pencils.—The Joseph Dixon Crucible Co., Jersey City, N. J., is distributing a pamphlet reproducing a speech made recently by J. A. Walker, Vice-President and General Manager of the Dixon Company, in which he gives a short history of lead pencils made in this country.

Manufacturing and Business.

The office of the Pressed Steel Car Co., in the City of Mexico, has been moved from its former address, Calle de Gante No. 8, to Prolongacion del 5 de Mayo No. 9.

The Expanded Metal & Corrugated Bar Co., St. Louis, Mo., has been awarded the contract for furnishing 405,000 lbs. of steel bars for the reinforcement of concrete at the Shoshone irrigation project, Wyoming.

Iron and Steel.

The New York, New Haven & Hartford and the Long Island are reported to be in the market for steel bridge material. The New York Central has ordered material for 15 bridges on the Pennsylvania, West Shore and Harlem divisions. The Western Pacific has ordered 5,500 tons of bridge steel.

The Missouri, Kansas & Texas is reported to be in the market for rails. A projected Texas Railroad is reported to be in the market for 75,000 tons, and a railroad company in Cuba for 5,000 tons of rails.

OBITUARY NOTICES.

John Mathieson, who recently retired as General Manager of the Midland Railway of England, died on August 9th. A portrait and sketch of Mr. Mathieson's career appeared in the *Railroad Gazette* of last week.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Alafia, Manitee & Gulf Coast.—See Charlotte Harbor & Northern.

Charlotte Harbor & Northern.—The officers of this company, formerly the Alafia, Manitee & Gulf Coast, are as follows: J. M. Gifford, New York, President; P. B. Bradley, Boston, Vice-President; L. M. Fouts, Jacksonville, Fla., Second Vice-President and General Manager; G. S. Bruce, Chief Engineer; C. B. McCall, Superintendent, and F. B. Higgins, Auditor, all with office at Hull, Fla.

Duluth & Iron Range.—Horace Johnson, Secretary, has been appointed Vice-President and General Freight and Passenger Agent, succeeding A. H. Viele, resigned.

New Park & Fawn Grove.—The officers of this recently opened road are: J. H. Anderson, President; J. A. Gailey, Secretary, and A. M. Strawbridge, all of New Park, Pa., and J. C. Wiley, General Manager, and P. F. Morris, Superintendent, Fawn Grove.

St. Louis, El Reno & Western.—The officials of the Fort Smith & Western have had their authority extended over the St. Louis, El Reno & Western, recently acquired by the Fort Smith & Western.

Operating Officers.

Atlantic Coast Line.—E. R. Wooten, Superintendent at Norfolk, Va., has been appointed Superintendent at Richmond, Va., succeeding J. P. Russell, transferred.

Denver & Rio Grande.—See Rio Grande Western.

Duluth, South Shore & Atlantic.—See Mineral Range.

Gulf, Colorado & Santa Fe.—W. E. Maxson has been appointed General Superintendent, with office at Galveston, Tex. A. P. Hall, Superintendent of Terminals at Galveston, Tex., has been appointed to the new office of Superintendent at Beaumont, Tex. The authority of Oliver Snyder, Superintendent of the Galveston division, has been extended over the Galveston Terminals.

International & Great Northern.—J. B. Allen has been appointed Car Accountant, with office at Palestine, Tex., succeeding M. H. Trice, recently appointed Assistant Superintendent at Mart, Tex.

Mineral Range.—T. W. Smith, formerly Assistant Superintendent of the Duluth, South Shore & Atlantic, has been appointed Superintendent of the Mineral Range, succeeding J. C. Shields, resigned to become General Superintendent of the Keweenaw Central, now under construction in Michigan.

Missouri Pacific.—C. E. Carson, who was recently appointed Superintendent of Terminals at Kansas City, Mo., was born in 1864 in Ohio, and educated at Carleton College, Syracuse, Ohio. He began railroad work in 1882 as a switchman on the Kansas City, Fort Scott & Gulf. He remained on this road until 1893, serving as yard master, conductor and chief clerk to the Division Superintendent. He was then appointed chief clerk to the Superintendent of the Terminal Railroad of St. Louis, and, in 1897, went to the Missouri Pacific as Superintendent of Terminals at Kansas City, Mo. He was transferred to St. Louis five years later, and, in 1903, went to the Colorado & Southern as Superintendent at Denver, where he remained until last May. He was then out of railroad service until his recent appointment.

Rio Grande Western.—W. E. Miller, Assistant Superintendent of the First division of the Denver & Rio Grande at Pueblo, has been appointed Superintendent, with headquarters at Salt Lake City, succeeding F. S. Elliott.

St. Louis & San Francisco.—Andrew O'Hara, Superintendent at Springfield, Mo., has been appointed General Superintendent of the First district, with office at that place, succeeding C. F. Resseguie.

Seaboard Air Line.—J. H. Witt, Trainmaster at Richmond, Va., has

been appointed Superintendent of the Third division, with headquarters at Atlanta, Ga. E. L. Ryan, Trainmaster at Waldo, Fla., has been appointed Superintendent of the Sixth division, with headquarters at Jacksonville, Fla.

Southern.—J. A. Heether, Superintendent at Charleston, S. C., has been appointed Superintendent of the Norfolk division. A. G. Jones, Superintendent at Pinners Point, Va., succeeds Mr. Heether.

Traffic Officers.

New Orleans & Northeastern.—J. B. Bannon has been appointed Assistant General Freight Agent, with office at New Orleans, La.

Engineering and Rolling Stock Officers.

Baltimore & Ohio.—G. B. Swingly, Assistant Division Engineer at Connellsville, Pa., has been appointed Division Engineer at that place, succeeding John Ware, resigned to go into other business.

Great Northern.—W. W. Breckenridge, Master Mechanic at Crookston, Minn., has been appointed Master Mechanic of the Montana Central, with office at Great Falls, Mont., succeeding F. M. Fryburg, recently appointed General Master Mechanic of the Central district of the Great Northern.

Lehigh Valley.—J. M. McMullin has been appointed Master Mechanic at Sayre, Pa., succeeding Willard Kells, transferred to Buffalo, N. Y.

Purchasing Agents.

San Antonio & Aransas Pass.—James Cowan has been appointed Purchasing Agent, with office at San Antonio, Tex., succeeding T. B. Palfrey, resigned to go into other business.

LOCOMOTIVE BUILDING.

The Western Pacific, it is reported, has ordered 20 locomotives from the Baldwin Works.

The Elgin, Joliet & Eastern will place orders for 10 consolidation (2-8-0) locomotives and six six-wheel switching (0-6-0) locomotives.

The Chicago, Lake Shore & Eastern, as reported in our issue of August 10, is about to place orders for five consolidation (2-8-0) road locomotives, five six-wheel switching (0-6-0) locomotives, and three eight-wheel (4-4-0) transfer locomotives.

CAR BUILDING.

The New Orleans Great Northern, it is reported, has ordered new passenger equipment.

The Southern Pacific is building 32 standard cabooses, with wood underframes, at its Sacramento car shops.

The Canadian Pacific, it is reported, will receive a large amount of new equipment in time for the moving of the western wheat crop.

The Elgin, Joliet & Eastern will place orders for 300 steel underframe gondola cars and 100 steel side dump cars, all of 100,000 lbs. capacity.

The St. Louis & San Francisco is asking bids on 500 box cars and 250 43-ft. steel frame flat cars. The box cars are to be the Frisco Rock Island common standard steel frame car.

The Chicago, Lake Shore & Eastern is about to place orders for 500 steel underframe drop end gondola cars, 350 steel side dump cars and 100 steel underframe flat cars, all of 100,000 lbs. capacity.

The Chicago Great Western has ordered eight cabooses from the American Car & Foundry Co., for September delivery. These cabooses will be 33 ft. 7⅝ in. long, 8 ft. 11¾ in. wide and 6 ft. 9 in. high.

The Grand Trunk Pacific, as reported in our issue of Aug. 3, has made a contract with Rhodes, Curry & Co. for 2,500 cars, delivery to commence this year and to extend over a period of five years.

The Chicago & North-Western has ordered 1,500 box cars, 700 gondola cars and 300 flat cars, all of 80,000 lbs. capacity, from the American Car & Foundry Co. These cars are for January, 1907, delivery, and are in addition to the cars ordered from the Pullman Co. and from Haskell & Barker.

RAILROAD STRUCTURES.

Columbus, Ga.—It is reported that the Central of Georgia will build a terminal station at this place.

Little Rock, Ark.—H. C. Link will open bids on August 20 for a brick station, with steel skeleton, to be built at this place for the St. Louis, Iron Mountain & Southern. The building will be 60 ft. x 290 ft., three stories high, and is to cost approximately $300,000. Work is to be begun on September 1.

San Francisco, Cal.—This company has bought for $800,000 a block of land near its present passenger station at Third and Townsend streets, and it is reported that a new station will be built on this property.

Spokane, Wash.—The Washington Water Power Co. is building a car barn 180 ft. by 580 ft. at this place, to have a capacity of 140 ft. Shops will be connected with the building.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Allentown, Tamaqua & Ashland.—See New York, Pittsburg and Chicago Air Line.

Arkansas Valley.—See Atchison, Topeka & Santa Fe.

Atchison, Topeka & Santa Fe.—This company has bought the Arkansas Valley, which is surveyed from Lamar, Colo., to Rocky Ford, 80 miles. Forty miles of road have been built and work on the remainder will be started at once.

Brush Creek & Crows Run.—See New York, Pittsburg & Chicago Air Line.

Butte & Plumas.—See Western Pacific.

Canadian Northern.—Bids will soon be asked for the building of a 50-mile road from Hawkesbury to Montreal. Work is already under way on a line from Ottawa to Hawkesbury, 50 miles.

Canadian Pacific.—Work is under way on an extension of the Manitoba & Northwestern branch from Sheho, its present terminus, to Prince Albert.

According to a Montreal despatch, the President of this company has announced that a line will be built through the Temiskaming district, in the northern part of the province of Quebec.

Cardenas Railroad Terminal Company.—This company has been incorporated in New Jersey, with $1,000,000 capital. The incorporators are: John S. Fiske, De Witt Bailey, Paul R. E. Steier, John H. Leary and Fred Blasenbrey.

Chambersburg & Western Electric.—Under this name incorporation will be asked on August 28 for a company with $500,000 capital to build a road from Greencastle, Pa., northward to Chambersburg, 10 miles. It is expected to later extend from Chambersburg to Shippensburg, and from that point through Cumberland County to Harrisburg, about 58 miles from Chambersburg. Surveys are under way.

Chihuahua & Pacific.—It is reported that this road will be extended from Chihuahua, Mex., northeast to the Rio Grande border, about 225 miles, and from its southwestern terminus, Minaca, westward to the Pacific coast, about 500 miles. Concessions for these lines have been obtained from the Mexican Government.

Cincinnati, New Orleans & Texas Pacific.—This road is being double-tracked between Cincinnati and Chattanooga. The line is also being straightened so that the distance between these cities will be shortened by about 60 miles, the existing line being 338 miles long.

Coeur d'Alene & Spokane.—It is announced that the Hayden Lake branch from Coeur d'Alene to Hayden Lake, seven miles, will be in operation early in September.

Denver, Enid & Gulf.—Under the name Denver, Kansas & Gulf, this road is being extended from Kiowa, Kan., the northern terminus of the D., E. & G., northeasterly to Medicine Lodge. From the last named point it will run northwesterly to a connection with the Englewood branch of the Atchison, Topeka & Santa Fe to Belvidere. Grading is completed to Medicine Lodge and tracks will soon be laid to this point. The work is being done by the Kansas Construction Co., which has sublet parts of it.

Denver, Kansas & Gulf.—See Denver, Enid & Gulf.

Erie.—This company has bought about 100 acres of land at Little Ferry, N. J., extending from the New York, Susquehanna & Western tracks to the Hackensack river. It is understood that new yards will be built on this land.

Georgia, Southwestern & Gulf.—Chartered in Georgia to build from Dawson via Albany to a point in Washington County, Florida. The new road is to have $300,000 capital. The incorporators are: W. M. Legg, H. J. Brewton, A. H. Russell, M. D. Powers, W. M. Gordon, Jr., of Georgia; W. H. Milton, Miami, Fla.; E. V. Babcock and F. R. Babcock, of Pittsburg; E. S. Peter and J. H. Pope, of Chicago.

Grand Trunk Pacific.—Location surveys have been made for

about 760 miles of the 790 miles comprising the Prairie section. Grading has been extended on this section to a point 165 miles west of Winnipeg.

HALIFAX & SOUTHWESTERN.—It is expected that this line, 236 miles long, under construction between Halifax, N. S., and Yarmouth, will be finished by August 20, and that regular train service will be established in October.

INDIANA, CLEARFIELD & EASTERN.—See New York, Pittsburg & Chicago Air Line.

INDIANAPOLIS, HUNTINGTON, COLUMBIA CITY & NORTHWESTERN (ELECTRIC).—This company, recently incorporated, has made a mortgage to the Central Trust Co., of Indianapolis, securing an issue of $1,500,000 five per cent. bonds of 1936. The company proposes to build a line from Indianapolis, Ind., to Goshen, via Columbia City and Huntington, about 150 miles, and the mortgage covers the division from Huntington to Goshen, 60 miles. Contracts for the grading, track and overhead work on this section have, it is reported, been let to M. B. Ryan, Silver Creek, N. Y. C. E. Merrifield is President, with office at Indianapolis, and I. D. Wiest is Secretary, Treasurer and General Manager.

INDIAN VALLEY.—See Western Pacific.

INLAND EMPIRE.—It is announced that the Spokane & Inland will be extended from either Moscow, Idaho or Palouse, Wash., to the Snake river, and thence to Lewiston, Idaho, 150 miles. The branch line from Spokane to Lake Pend d'Oreille, 56 miles, will, it is expected, be in operation within a year. This branch parallels the projected line of the Spokane-Lake Pend d'Oreille Rapid Transit line.

MCCLOUD RIVER.—This company is about to close contracts for extending its road 13 miles west from McCloud, Cal.

MEXICAN ROADS.—A concession has been obtained from the Government to build a road from Guiterrez, on the Mexican Central, to Chalchihuites, and also a line from Guiterrez to Nieves, with a branch line to Ciudad de Jerez. The Rothchilds are reported to be behind this project, the purpose being to develop mines in which they are interested.

MISSOURI & NORTH ARKANSAS.—This company, recently incorporated as the successor of the St. Louis & North Arkansas, has been authorized by the shareholders to contract with the Allegheny Improvement Co., of Illinois, to extend the line from Seligman, Mo., the northern terminus, to Joplin, Mo., 50 miles, and also from Leslie, Ark., the southern terminus, southwesterly to a point on the Mississippi river, either Helena or Memphis, about 140 miles. (See St. Louis & North Arkansas, July 13, p. 12.)

MISSOURI ROADS.—It is stated that incorporation is to be asked for at once for an interurban road from Jefferson City, Mo., to Sedalia, 83 miles. C. W. Thomas, of Jefferson City; Nelson Leonard, of Bunceton, and J. H. Decker, of Sedalia, are mentioned in this connection.

NATIONAL RAILROAD OF MEXICO.—This company is planning to make standard gage the present narrow gage line from Gonzalez Junction to Mexico City, 231 miles. This division formed a part of the main line until a few years ago, when a cut-off was made between the two points named. The 54 miles of road between Gonzalez and Acambaro will be made standard gage at once at a cost of about 750,000, and the estimated cost of standardizing the entire line is about $2,000,000.

NEW PARK & FAWN GROVE.—This road, running from Stewartstown, Pa., to Fawn Grove, 12 miles, was formally opened on Aug. 9th.

NEW YORK CENTRAL & HUDSON RIVER.—It is reported that the Pennsylvania, Beach Creek & Eastern Co., recently incorporated as a holding company for the New York Central's coal properties in the Beach Creek region, will build a road from a point near Williamsport on the New York Central to connections with other railroads. The Erie, D., L. & W., Lehigh Valley and Pennsylvania all have lines in this region.

This company has bought about 50 acres of land at Little Ferry, N. J., which is directly west of the Weehawken terminals of the West Shore. It is said that the land will be used for additional yards. See Erie Railroad.

NEW YORK, ONTARIO & WESTERN.—The Scranton division of this road running from Cadosia, N. Y., on the main line southwesterly to Scranton, Pa., 54 miles, is being double-tracked. The work is being done by the company's forces.

NEW YORK, PITTSBURG & CHICAGO AIR LINE (ELECTRIC).—It has been announced that there is a project under way to build a low-grade double-track electric railroad from New York to Pittsburg, with Chicago as the ultimate western terminal. The road is to be built under the management of Joseph Ramsey, Jr., formerly President of the Wabash. Mr. Ramsey has made the following statement in regard to the project:

"We expect to make a start this fall and begin work next spring, hoping to complete the line between Pittsburg and New York within three years. The cost of the line between Pittsburg and New York is estimated to be between $75,000,000 and $100,000,000, all of which has been pledged, the bulk of it by foreign capitalists. It would not be wise for me to give details or names now.

"The line is not merely a preliminary survey, but a final location that has been revised three times. Three corps of engineers have been busy for three years. It is the best possible short low-grade line to be secured through Pennsylvania between Pittsburg and New York. The extension of the road west to Chicago from Pittsburg will be taken up when the line east to New York is completed."

The new road is to be operated by electric locomotives. It is to be 65 miles shorter between New York and Pittsburg than the Pennsylvania, and, when extended to Chicago, will be 108 miles shorter than the Pennsylvania, the shortest line at present between those points. The Pennsylvania mileage between New York and Pittsburg is 445 miles, as against 380 miles by the projected line, and 330 miles by a perfect air line. Between New York and Chicago the distance over the Pennsylvania is 913 miles; by the New York Central-Lake Shore route, 980 miles, and by the Erie, 999 miles. The new company expects to secure a line between 805 and 815 miles long. The air line distance between New York and Chicago is 748 miles. The announcement of the project was made in connection with the filing of papers for the consolidation of the Indiana, Clearfield & Eastern, the Allentown, Tamaqua & Ashland, and the Brush Creek & Crow's Run railroads, three projected lines in Pennsylvania. The two former will, it is reported, form the main part of the new road in Pennsylvania. The route of the new road as given in the despatches is from Pittsburg east along the Allegheny river to its junction with the Kiskiminetas opposite Freeport, along that stream for several miles to a point near Leechburg, where it is to cross Crooked creek and run up that stream through South Bend, Shelocta and Creekside; thence across Black Lick creek and the Divide to the west branch of the Susquehanna river, which is to be crossed at Cherry Tree, on the New York Central's Pennsylvania division in the Clearfield region. From Cherry Tree the route is via Westover, near Irvona, on the Bells Gap line of the Pennsylvania at Beccaria, across the height of land in the Allegheny mountains near Sandy Ridge, at an elevation 400 ft. lower than the elevation reached by the Pennsylvania's main line at Gallitzin, where it crosses the summit. This low elevation is to be obtained by a tunnel nearly a mile long, after passing through which the road is to descend the eastern slope of the mountains, crossing the Bald Eagle Valley near Dix station, a short distance from Tyrone; thence running through Loveville, Gatesburg, Pine Grove Mills, Shingleton, Tusseyville, and along Penn Creek to New Berlin. Here branches may be built to Sunbury, on the Philadelphia & Reading, and Northumberland, on the Delaware, Lackawanna & Western. The main line is to continue eastward, crossing the valley of the Susquehanna at Selins Grove; thence following Mahanoy Creek, through Ashland and Mahanoy to Buck mountain, where a 3,000-ft. tunnel is to be built. By way of Tamaqua the road then is to reach Lizard Creek, and the second 5,000-ft. tunnel is to be built here to Jordan's Valley; thence the route is to Allentown on the Lehigh river, Easton on the Delaware, and from Easton into Jersey City.

NITANNY.—Incorporated in Pennsylvania with $40,000 capital to build a line four miles long in Clinton County from Cedar Springs north to Millhall, where connection is to be made with the Pennsylvania division of the New York Central. W. C. Lingle, of Patton, is President.

PENNSYLVANIA, BEACH CREEK & EASTERN.—See New York Central & Hudson River.

PENNSYLVANIA LINES WEST.—There has been appropriated $10,000,000 with which to bore the Pittsburg tunnel of the P., C., C. & St. L. through to Daylight, and build a new union station at Fifth avenue and Grant street, opposite the old St. Paul Cathedral site. The tunnel will be widened to 150 ft. and aqueducts will be placed in the streets the road crosses, making it possible to maintain a high rate of speed through the tunnel.

PITTSBURG, HARMONY, BUTLER & NEWCASTLE (ELECTRIC).—Contracts have been let for the building of this line connecting the cities included in the above name. The distance is about 70 miles, and an issue of $3,500,000 bonds has been made. Union Trust Company, Trustee.

ST. LOUIS & NORTH ARKANSAS.—See Missouri & North Arkansas.

ST. LOUIS & SAN FRANCISCO.—President A. J. Davidson recently made an overland trip over the route of a proposed new branch line, 150 miles long, which is to run from Dublin, Tex., on the Fort Worth & Rio Grande division, north to Thurber, on the Texas & Pacific, 50 miles, and from Dublin south to Lampasas, 100 miles. There are extensive coal mines at Thurber.

According to a report from Austin, Tex., it has been announced

by President Davidson that work on an extension of the Fort Worth & Rio Grande division from its present terminus at Brady south to San Antonio, 150 miles, will soon be begun.

Spokane & Big Bend Electric.—The President of this road, which is projected between Spokane, Wash., and Davenport, 120 miles, is quoted as saying that the road will be in operation before June, 1907. Surveys have been completed and 90 miles of the right of way has been bought. It is stated that work will begin this month.

Texas Northern.—This company has been incorporated in Texas to build from Fort Worth, Tex., south to Egan, and from that place northeasterly to Dallas, 60 miles in all. The general offices are at Fort Worth and the incorporators are: Oscar Wells, G. H. Colvin and J. B. Daniel, of Fort Worth; Rhoades S. Baker, Sidney Reinhard, Royal A. Ferris and Henry E. Jackson, of Dallas; W. A. McDonald, of Cleburne, Tex.; B. P. McDonald, of Fort Scott, and David Bedell, of Iola, Kan.

Valdez, Marshall Pass & Northern.—Work is begun on this line from Valdez on the bay of that name in Alaska to Eagle City on the Yukon river, 412 miles. About 10 miles of this line has been graded. The company has $10,000,000 capital stock and $3,000,000 first mortgage, series A, 5 per cent. bonds of 1936 authorized. The bonds are subject to call at 105 and about $400,000 have been issued. The first 100 miles of road is to be built and equipped with the proceeds of the bonds issued and to be issued.

Versailles & Sedalia.—Work is under way on this road running from Versailles, Mo., northeasterly six miles to the property of the Missouri Cannel Coal Mining Co. Grading is completed half way. The maximum grade is 2 per cent. and the maximum curvature 3 per cent. J. Applewhite is President and H. A. Bailey, Chief Engineer. The general offices of the company are at Versailles.

Washington & Gettysburg.—Incorporated in Pennsylvania with $80,000 capital to build a line from Gettysburg, Pa., at the intersection of the Western Maryland and the Gettysburg & Harrisburg, to Harpers Hill in Freedom Township, Adams County, eight miles. J. W. Le Gore, of Le Gore, Md., is President, and the Directors are W. H. O'Neill and W. T. Ziegler, Gettysburg; J. R. Birkholder, of Lancaster; R. S. Potter, of Philadelphia; C. A. Welker and W. B. Stanbaugh, of Woodsboro.

West Coast Traction.—This company has been incorporated in Washington, with $450,000 capital, to build a line from Olympia, Wash., to Tacoma, 320 miles, including branches. The incorporators are: C. H. Weeks and Cyrus Bradley, Spokane; B. J. Weeks, Tacoma; A. D. Leverson, London, England; J. W. Reynolds, Chehalis, and F. B. Hubbard and W. W. Cannon, of Centralia.

Western Pacific.—This company has bought rights of way through the Feather river canyon, northeast of Oroville, and up the Indian Creek Valley, about 80 miles in all, from the Butte & Plumas and the Indian Valley Railroads. An application has been made to the County Clerk of Butte County, California, for the voluntary dissolution of these two companies.

Yakima Valley Traction.—This company has been incorporated in Washington, with $500,000 capital, to build 120 miles of road in the Spokane and Yakima valleys. W. A. Bell, of North Yakima, is interested.

RAILROAD CORPORATION NEWS.

Atchison, Topeka & Santa Fe.—This company is reported to have bought the Gulf & Interstate, which runs from Beaumont, Tex., to Fort Bolivar on Galveston Harbor, 70 miles. It owns terminals in Beaumont and about 500 acres of land on Galveston Harbor. The capital stock is $71,000, and it has $829,000 authorized first mortgage 5 per cent. bonds of 1915.

Baltimore & Ohio.—The gross earnings of this company for July, 1906, were $6,544,846, an increase of $776,017; net earnings, $2,196,859, an increase of $178,934.

Boston, Revere Beach & Lynn.—This company is offering at 108½ and interest $289,000 first mortgage 4½ per cent. bonds of 1927. The authorized issue is $1,000,000, and the recent sale of this makes the total amount outstanding $850,000. The bonds now being sold are for the purpose of refunding a like amount of 5 per cent. bonds of the Boston, Winthrop & Shore, which has eight miles of narrow gage road near Boston and is owned by the Boston, Revere Beach & Lynn.

Camden Interstate (Electric).—The control of this company has passed to W. C. Sproul, of Chester, Pa., and associates. The company owns the street railroads and lighting plants of Huntington and Kenova, W. Va.; Catlettsburg and Ashland, Ky., and Ironton, Ohio, and lines connecting these places, operating altogether about 50 miles of road. W. C. Sproul is President of the Kanawha Valley Traction Co., and also controls it. The last named road owns street railroads in Charleston, W. Va., and the Camden Interstate is extending its line to that point from Huntington, 50 miles.

Canadian Northern.—The $3,809,140 first mortgage, 6 per cent. bonds of the Qu'Appelle, Long Lake & Saskatchewan are to be retired by being exchanged for 30-year 4 per cent. mortgage debenture stock of the company, guaranteed by the Canadian Northern, which recently purchased it. Every $100 in bonds is to be exchanged for $107 in debenture stock, while the scrip certificates outstanding issued in payment of interest on the old bonds will be exchanged for 30 per cent. of their face value.

Canadian Pacific.—This company has sold 300,000 acres of timber land on Vancouver Island, formerly the property of the recently acquired Esquimalt & Nanaimo, to the MacLaren Lumber Company for a price said to be $10 an acre.

Central of Georgia.—The earnings of this company during the fiscal year ended June 30, 1906, were sufficient to continue the payment of interest on all three classes of income bonds, begun in 1905, and to leave a surplus of $500,671 after charges, an increase of $396,154. The gross earnings were $11,396,123, an increase of $1,261,068; net earnings, $3,160,910, an increase of $443,821. Fixed charges, including interest on equipment trust obligations and on funded debt and rentals, increased from $2,110,936 to $2,184,860, leaving a balance of $1,250,671, out of which was paid the $750,000 5 per cent. interest on the $4,000,000 first preference income bonds, $7,000,000 second preference, and $4,000,000 third preference. There was no change in mileage during the year.

Chicago, Indiana & Eastern.—This company, which owns 43 miles of road between Converse, Ind., and Muncie, and has been in the hands of a receiver since September, 1904, earned during the three months ended May 31, 1906, $105,459. The net earnings were $16,973, this rate being about 70 per cent. more than in the year before the road went into the hands of the receiver.

Chicago Union Traction.—A protective committee of stockholders of the Chicago West Division Railway has been formed for the purpose of fighting the proposed reorganization plan of the Chicago Union Traction lines. The committee consists of Byron L. Smith, Cyrus H. McCormick, Chauncey Keep and John F. Bass.

Cincinnati, Hamilton & Dayton.—Testimony given on August 13 at the hearing before a referee in the interests of President Bradford, of the Chicago, Indianapolis & Louisville, showed that J. P. Morgan & Co. bought C., H. & D. stock at $165 a share, instead of $160, as has been supposed heretofore. If, as is understood, the firm bought 75,000 shares, the purchase price was $12,375,000, instead of $12,000,000.

Grand Trunk Pacific.—The Grand Trunk Pacific Town & Development Co. has been incorporated in Canada with $5,000,000 capital.

Gulf & Interstate.—See Atchison, Topeka & Santa Fe.

Intercolonial.—The Minister of Railways and Canals announces that it is the intention of the Canadian Government to purchase within a short time several branch railroads in this province which connect with the Intercolonial.

Missouri & North Arkansas.—This is the new name of the St. Louis & North Arkansas, recently reorganized.

New York, Ontario & Western.—The statement of earnings for the year ended June 30, 1906, shows that the troubles in the Pennsylvania coal region during the last few months of the fiscal year were enough to more than offset the increases in the earnings of this road made during the first nine months. The gross earnings were $7,265,057, an increase of $174,169, but the operating ratio increased from 71 per cent. to 72 per cent., so that the net earnings fell off to $2,031,770, a decrease of $8,369. The charges increased $85,407, leaving as surplus $1,187,500, a decrease of $93,776.

Norfolk & Western.—With an average of 1,839 miles operated, an increase of 40 miles, the gross earnings of this company for the year ended June 30, 1906, increased from $24,089,260 to $28,487,766, about 18 per cent. The operating expenses increased only 17 per cent., leaving net earnings of $11,423,142, an increase of $1,948,316, 21 per cent., the operating ratio being 60 per cent. as compared with 61 per cent. last year. The surplus after charges was $7,302,353, an increase of $1,588,128.

Qu'Appelle, Long Lake & Saskatchewan.—See Canadian Northern.

St. Louis & North Arkansas.—See Missouri & North Arkansas.

Southern Pacific.—It is definitely understood that at the meeting of the board of directors to be held this week, a dividend will be declared on the $128,307,960 outstanding stock on which no dividend has heretofore been paid.